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ELECTRICAL ENGINEERING ABSTRACTS

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ELECTRICAL ENGINEERING ABSTRACTS

Volume 63 **JANUARY 1960** **Number 745**

With this issue of "Electrical Engineering Abstracts", which commences Volume 63, some changes have been made in the arrangement of the abstracts. The full list of the "chapters" into which the abstracts are divided is printed inside the front cover, and it will be seen by comparing this with the last volume that some new headings have been introduced, some of the old ones have been modified, and the order of the chapters partly rearranged.

The aim of these changes is to bring closely related subjects into more intimate association, either within the same chapter or a sequence of chapters. It is hoped that the reader will find this an added convenience to him. For example, "Control systems", "Computers and applications", "Telecontrol" and "Telemetering" have been coordinated under "Control. Data processing". This arrangement is inevitably experimental in many respects and some modification and evolution is to be expected; readers are invited to cooperate in this, and their comments and advice will be very welcome.

Those of our readers who are familiar with the Universal Decimal Classification system will note that the arrangement of chapters has incurred some departure from strict U.D.C. order. However, for the benefit of any who use the U.D.C. to file away individual abstracts, classification numbers will still be allotted to each abstract and abstracts within each chapter will be arranged in numerical order.

GENERAL

(For abstracts on circuit theory see also Lines . Networks . Filters)

614.825

1 SHOCK HAZARDS OF ELECTRIC CURRENTS. A.R.Morse, Jr.
Engng J., Vol. 42, No. 11, 50-4 (Nov., 1959).

Some of the work published over many years is quoted, with the addition of accounts of some new tests and assumptions. The factors of current, duration, frequency, contact, etc., are considered, with notes on the physiological aspects. It is concluded here that a change in voltage from 120 to 240 V to earth, in Canada, would result in about double the fatalities due to electric shock. E.H.W.Banner

614.825

2 RUBBER SAFETY MAT FOR LIVE LINE WORK.
Elect. Engr (Melbourne), Vol. 36, No. 7, 54-5 (Oct. 10, 1959).

A rubber sheet or mat has been developed in Sydney as a linesman's safety guard when working on l.v. o.h. lines. The mat has holes along each edge and is hung over each line successively and fixed with polythene dowels through the holes. Each line other than the one to be worked on is covered in this way before the linesman moves up to the line level. E.H.W.Banner

621.3 : 378.1

3 ENGINEERING EDUCATION AT THE TECHNICAL UNIVERSITIES IN WESTERN GERMANY.
D.B.Welbourn, D.B.Spalding and G.L.Ashdown.
Proc. Instn Elect. Engrs, Paper 2913, publ. May, 1959 (Vol. 106A, 409-19).

Republication, with discussion, of the paper abstracted in Abstr. 3304(1959).

621.3 : 378

4 PROBLEMS OF ENGINEERING EDUCATION.
Proc. Instn Elect. Engrs, Report 2987, publ. May, 1959 (Vol. 106 A, 420-3, 424-8).

Republication, with discussion, of the paper abstracted in Abstr. 3908 (1959).

621.3 : 550.3

5 THE FIFTIETH KELVIN LECTURE "THE INTERNATIONAL GEOPHYSICAL YEAR 1957-58". D.Brunt.
Proc. Instn Elect. Engrs, Paper 3035, publ. Sept., 1959 (Vol. 106B, 437-43).

621.3.012.8

6 A NEW VIEW OF ELECTRO-MECHANICAL ANALOGIES. L.Cremer and K.Klotter.
Ingen.-Arch., Vol. 28, 27-38 (1959). In German.

621.3.015.5

7 THE IMPULSE BREAKDOWN OF UNIFORM-FIELD GAPS IN AIR. INTERIM REPORT. R.Galloway.
Rep. Brit. Elect. Res. Assoc., Rep.L/T357, 10 pp.(1957).

The relation between overvoltage and formative time-lags to breakdown in a uniform-field gap in air at atmospheric pressure was investigated. The method involved the application of the voltage to the electrodes in the form of an impulse wave approximating to a unit function. The apparatus is described, and the results so far obtained for gaps up to 4 cm are given. The overvoltages used range from about 3% down to zero.

POWER RESOURCES
PRIME MOVERS

620.92

8 A METHOD OF DETERMINING THE POWER POTENTIAL OF RIVERS WITH MANY RESERVOIRS AND POWER PLANTS. G.S.Cavadias.
Engng J., Vol. 42, No. 10, 103-7 (Oct., 1959).

The method presented is based on previous work by Johnstone and Hackney and considers the total power production of the system as the basis for the computations. In addition to the total power potential of the system, the productions and the installations of the individual plants are also determined. The theoretical basis for the computations is given and an example of the application of the method to a typical hydro-system is included.

621.224

9 ACCEPTANCE TESTS ON WATER TURBINES. P.U.Weber.

Bull. Assoc. Suisse Elect., Vol. 50, No. 14, 653-5 (July 4, 1959). In German.

A comparison of the present V.D.I. and S.E.V. water turbine codes. The German Code makes provision for acceptance tests during the design of the scheme and efficiency steps of 0.2% (not 0.1%) are used for the premium and penalty clauses. The Swiss Code recognises the equal rights of the two parties so that the tolerances are applied to give minimum premium and penalty.

P.Linton

POWER SUPPLY
POWER STATIONS

621.311.1

10 AFRICA — SOUTH OF THE SAHARA. I-III. E.H.Bellairs.

Elect. Times, Vol. 136, 312-14 (Oct. 1); 393 (Oct. 15); 618-21 (Nov. 26, 1959).

Part I covers the electricity supply of Mozambique and Madagascar. In 1956 the total installed capacity of Mozambique was 55 232 kW. Power stations in Madagascar with a total installed capacity of 41 700 kVA are briefly described. Part II gives details of power stations and schemes in Angola. Part III considers supply and power plants in French West and Equatorial Africa.

Central Electricity Generating Board Digest

621.311.1

11 ON METHODS FOR DETERMINING FUTURE POWER DEMANDS. A.Dumitresku, M.Eleftheresku and Sh.Kovach.

Elektrichestvo, 1959, No. 8, 26-9 (Aug.). In Russian.

Formulae and graphs are presented by the use of which it is claimed that close approximate forecasts can be made of prospective energy requirements, particularly in regard to future demands for power and heating. The forecasts take into consideration such factors as industrial expansion, new methods arising from technical advances, analysis of mechanization and automation, economics of further capital outlay, and the general effects produced in a national system of planned economy.

H.E.Crowcroft

621.311.1

12 DEVELOPMENTS IN THE FAROE ISLANDS. P.Guldberg.

In Danish.

The biggest supply company began service in 1953 and supplies three of the main islands, serving 26 communities which include the capital, Thorshavn. Generation is exclusively hydro-electric, 15×10^6 kWh having been produced during the past operational year. Consumption is divided between domestic users (70%); industry, mainly fish-curing and freezing (20%); other users (10%). One 3000 h.p. Pelton turbine was originally installed and later supplemented by a 6000 h.p. Francis turbine. Transmission is at 20 kV over 3 o.h. lines. Crossings between the islands are made by one copperweld 1500 m span and one 3000 m span steel cable. No masts are used at the crossings, the cables being anchored to the cliffs. Further development of hydro-electric resources is planned, the necessary capital investment being discussed.

G.N.J.Beck

621.311.16

13 THE DAILY ECONOMIC LOAD-DISTRIBUTION SCHEDULING OF COMBINED THERMAL AND HYDRO-ELECTRIC POWER SYSTEM. D.M.Grobman and Yu.I.Smirnov.

Dokl. Akad. Nauk SSSR, Vol. 127, No. 3, 545-8 (July 21, 1959). In Russian.

Presents a method for optimum economic scheduling to satisfy the needs of each consumer—using a desired quantity of water at each hydro-electric plant, when the fuel input of thermal plants is at its lowest. The solution is obtained by graphical determination and gradually improving the successive working stages. The final vectors can be found by solving linear algebraic equations, the number of which equals the number of hydro-electric plants.

Z.Koprowski

621.311.161

14 DECREMENT OF FAULT CURRENTS IN INTER-CONNECTED NETWORKS FED FROM SEVERAL POWER PLANTS. M.Vajta.

Acta tech. Hungar., Vol. 25, No. 3-4, 217-46 (1959).

In an interconnected network the calculation of the decrement of short-circuit currents is customarily carried out by the transient internal voltage method. Good accuracy is obtained where the ratio of synchronous to transient reactance is not excessively high; many synchronous machines in use on the Continent have ratios as high as 10 : 1, in which case substantial errors are introduced. A new method of calculation is described which takes into consideration the variation in time constant during the decremental period and gives greater accuracy.

M.Rathbone

621.311.16 : 681.142

DIGITAL CALCULATIONS OF POWER SYSTEM SWING-CURVES AND THEIR ACCURACY. See Abstr. 587

621.311.161

15 INTERCONNECTED POWER SYSTEMS. J.H.M.Sykes.

Engineering (London), Vol. 188, 90-1 (Aug. 28, 1959).

The basic motives which lead different countries to link their systems together are briefly examined and factors which may change the electrical picture, and so militate against further interconnection are discussed. Seasonal exchanges of power are described and improved load factors and the benefits of interconnection are indicated. Present-day power interchanges in Europe are illustrated.

Central Electricity Generating Board Digest

621.311.21

16 SHIN — 38 MW PROJECT NEARING COMPLETION. Elect. Rev., Vol. 165, No. 13, 587-93 (Nov. 6, 1959).

This scheme consists of five power stations and three dams with a catchment area of 254 mile^2. A group control centre is located in Shin power station and a horizontal propeller type turbine has been installed at the Shin diversion station.

621.311.21

17 SILVER FALLS GENERATING STATION. P.R.Stratton and C.T.Bath.

Engng J., Vol. 42, No. 10, 108-10, 122 (Oct., 1959).

A brief description of the civil engineering methods used in the construction of the tunnel shaft (2 miles long, 17ft 6in diameter) for this hydro-electric station is given.

621.311.21

18 PUMPED STORAGE CAPACITY CORRELATED TO BASE-LOAD ELECTRIC ENERGY GENERATION: A SIMPLIFIED MATHEMATICAL APPROACH. C.Jaeger.

Proc. Instn. Civil Engrs. Vol. 14, 291-318 (Nov., 1959).

An attempt is made to represent the economics of pumped storage with simple formulae and a few typical diagrams. These are not supposed to replace detailed calculations on digital computors by specialized teams of planning engineers but to provide a rapid and convenient means of estimating the general trend of prices. The method starts with the analysis of the system load factor and takes full advantage of load/duration curves for determining the main characteristics of pumped-storage schemes and discussing their integration in a main electric system. Price equations are developed, the economics of pumped storage analysed, and basic equations for the required storage volume given. These show the advantages of operating a continuous chain of medium-head pumped-storage stations on the same river. The problems of pumping-cycle efficiencies and of losses are analysed. The paper is submitted as "a simplified mathematical approach" to the correlation of base load and peak load.

621.311.21

19 MINIATURE ASYNCHRONOUS POWER STATIONS [MICROCENTRALES ASYNCHRONES]. G.Gousset.

Rev. S-W, No. 28, 2-13 (March, 1959). In French.

A generating set for microstations consisting of a propeller turbine with adjustable blades discharging into an inverted syphon passing over the dam. The sealed alternator is below the turbine

and can be of optimum flat shape irrespective of hydraulic considerations. The complete unit can be erected by a simple crane and the foundations consist of 3 mounting spigots. Fifteen sizes from 75 to 600 kW are available and a peak efficiency of 90% has been achieved.
P.Linton

621.311.21

20 THE GARRY AND MORISTON DEVELOPMENTS. II.
Water Pwr, Vol. 11, No. 7, 246-55 (July, 1959).
For abstract and Pt I, see Abstr. 4981 of 1959.

621.311.21

21 THE UPPER VINSTRA SCHEME.
Water Pwr, Vol. 11, No. 9, 349-53 (Sept., 1959).
This scheme supplements the Vinstra development (see Abstr. 2477 of 1956) in Norway. The 96 m long concrete dam stores 74×10^6 m^3 in Lake Vinsteren. A tunnel 7.5 km long and 32 m^2 in area passes under a lake and terminates in a 19 m^3 surge tank with upper and lower expansion chamber. The lined pressure shaft 520 m long slopes at 41° and runs to the underground station containing 2 vertical Francis turbines operating under 320 m head and driving 75 MVA 13 kV 428 rev/min alternators. Three 1-ph. underground transformers and 220 kV cables connect to the outdoor switchgear. The station is controlled from Lower Vinstra over a carrier-current link.
P.Linton

621.311.21

22 THE VIBRATION OF PENSTOCKS.
F.Kito.
Water Pwr, Vol. 11, No. 10, 379-85, 92 (Oct., 1959).
This problem is discussed analytically and on the basis of detailed investigations that have been carried out on certain Japanese plants. An original formula for the actual frequency of vibration of a penstock is presented, and cases where vibration trouble has been cured are cited.

621.311.21

23 ATIAMURI POWER STATION, NEW ZEALAND.
Water Pwr, Vol. 11, No. 10, 393-6 (Oct., 1959).

621.311.22

24 GENERATING STATION MAINTENANCE.
G.Nicholson.
Elect. Rev., Vol. 165, No. 4, 179-82 (Sept. 4, 1959).
Plant availability, and hence planned preventive maintenance, has assumed greater importance as the size of turbo-alternator-boiler units has increased. Methods of planning and controlling a maintenance system and the keeping of cost and plant records are discussed, but it is contended that the first essential is a sound overall station organization.
G.V.Hargreaves

621.311.22

25 WILLINGTON "A" POWER STATION.
Engineer, Vol. 208, 392-4 (Oct. 9, 1959).
Willington "A" power station has an output of 400 MW from four 100 MW sets, all of which are hydrogen cooled (one set having direct cooling of stator and rotor windings). The four boilers are of semi-outdoor construction and are arranged in the form of a square with a central mill aisle and separate turbine rooms on opposite sides of the boiler block. Each boiler is rated at 830 000 lb/hr with stop-valve conditions of 1600 lb/in^2 and 1060°F. Two 200 MW sets will be installed in Willington "B" station being built to the north of "A" station to share the coal and cooling water facilities.

621.311.22

26 SPECIAL FEATURES OF THE BRANDON GENERATING STATION. A.C.Blue, E.M.Scott, W.P.London, A.C.Shamess and P.A.Pasquet.
Engng J., Vol. 42, No. 7, 54-62 (July, 1959).
This is the first thermal station of the Manitoba hydroelectric board located in the western load centre of the area. Four 33 MW sets were found to provide greatest increase in firm system capacity (142 MW). Local lignite is burnt in pulverized units without complete drying. The forced-draft cooling towers permit flexible operation with low and reverse speed to cope with icing conditions.
P.Linton

621.311.22

27 THE FIRST CYCLONE FIRED BOILERS IN CANADA AND SOME ASPECTS OF THEIR EARLY OPERATION.
E.K.Akin.
Engng J., Vol. 42, No. 10, 85-95 (Oct., 1959).

621.311.25

28 THE P.W.R. IN THE POWER FIELD.
A.Point.
Electrotechniek, Vol. 37, No. 20, 453-6 (Oct. 1, 1959).
Describes the project for a power station with pressurized water reactor for use in Belgium and Holland. The plant will have a power output of 165 MW and will use uranium enriched to < 3%. The reactor core contains approx. 40t of uranium, which is in the form of UO_2 sintered in cylindrical pellets. There are 21 900 fuel rods consisting of 1 cm dia. stainless steel tubes filled with the pellets. The primary system pressure is 151 kg/cm^2, primary water temp. 270°C, the inlet and outlet temperatures of water from the reactor vessel differing by only 25°C. In the secondary system, four steam generators produce 1060 t/hr of steam at 35 kg/cm^2.
G.N.J.Beck

621.311.25

29 SAFETY PROBLEMS FOR PRESSURIZED-WATER REACTORS. M.Hoyaux.
Electrotechniek, Vol. 37, No. 20, 456-8 (Oct. 1, 1959). In Dutch.
See also preceding abstract. From the point of view of contamination the p.w.r. plant is very safe, since the water in contact with fissionable material does not enter the secondary system which includes the turbines and condensers. The turbo-generators can therefore safely be located in conventional buildings. Curves are given showing the reactor temperature following an accidental shut-down of two of the four water pumps, and the change in output and neutron density following an accidental withdrawal of the control rods. Both sets of curves show an initial rise, then a flattening off, in the second case followed by a drop. The radioactive material has in effect four types of shielding: the UO_2 itself which has a high melting point and resists diffusion, the sheath of stainless steel, the pressure vessel of stainless steel, and finally the concrete shield and solid construction of the building.
G.N.J.Beck

621.311.25

30 THE DESIGN OF A DANIELS-BOYD NUCLEAR STEAM GENERATOR A 400 MW. (NET E) POWER PLANT.
W.Boyd, J.A.Paget and P.Hamel.
Engng J., Vol. 42, No. 10, 111-18, 122 (Oct., 1959).
A full description of the Canadian nuclear steam generator, suitable for use in a public utility power station and incorporating an active circuit, helium cooled, ceramic reactor of the general type first proposed by Daniels.

621.311.42

31 FOUR 115/6 kV OUTDOOR SUBSTATIONS FOR THE WATER SUPPLY SYSTEM OF CARACAS.
R.Classen and F.Marder.
A.E.G. Progress, 1958, No. 4, 288-92.
English translation of a paper already abstracted in Abstr. 3922 (1958).

621.311.4 : 621.398

REMOTE-CONTROLLED OPERATION OF SUBSTATIONS.
See Abstr. 542

621.311.6

32 ELECTRICAL SUPPLIES TO POWER STATION AUXILIARIES. D.A.Dewison.
Proc. Instn Elect. Engrs, Paper 2759S, publ. Dec., 1958 (Vol. 106A, 451-69).
Republication, with discussion, of the paper abstracted in Abstr. 43(1959).

621.311.47 : 621.398

REMOTE CONTROL OF MEDIUM-VOLTAGE DISTRIBUTION SUBSTATIONS. See Abstr. 543

ELECTRIC MACHINES

621.313.1

33 COMMUTATION IN MULTISTAGE ROTARY AMPLIFIERS WITH LONGITUDINAL FIELD.
B.F.Tokarev.
Elektrichestvo, 1959, No. 7, 13-18 (July). In Russian.
In an example of a 3-stage amplifier, whose connections and operation are described, it is shown that three currents, which differ in phase and frequency, flow in the armature. Consequently the

e.m.f's. of commutation produced by each current differ from each other. A special connection of commutating poles is described which will ensure good commutation at various loads. A numerical example of calculating the ratio of commutating reactances of two stages of amplification is given. A.Karlsbad

621.313.13

34 THE MOTOR DRIVE AS THE MAIN ELEMENT IN A CONTINUOUS ROLLING MILL SYSTEM.
N.N.Druzhinin.
Elektrichestvo, 1959, No. 9, 35-40 (Sept.). In Russian.

The properties of the electric drive system and their effect on the rolling process are examined, and an analysis of such a system is included. Metropolitan-Vickers

621.313.2-9

35 THE NEW SERIES OF GMH DIRECT-CURRENT MOTORS OF ROLLING-MILL AUXILIARY DRIVES AND HOISTS IN OCTAGONAL CONSTRUCTION WITH SILICONE INSULATION.
K.Wark.
A.E.G. Progress, 1958, No. 4, 317-18.

English translation of a paper already abstracted in Abstr. 3925 (1958).

621.313.292 : 621.34

36 AN ELECTROMAGNETIC VARIABLE-RATIO TORQUE CONVERTOR. D.O.Bishop and G.S.Brosan.
Proc. Instn Elect. Engrs, Paper 2861U, publ. April, 1959 (Vol. 106A, 485-9).

Republication, with discussion, of the paper abstracted in Abstr. 1929(1959).

621.313.3

37 UNUSUAL APPLICATIONS FOR CONVENTIONAL SYNCHROS. D.J.Salonimer.
Electronics, Vol. 32, No. 39, 84-6 (Sept. 25, 1959).

The applications include single-, two- and three-phase low-frequency generators, linear induction potentiometers, carrier phase-shifters and rotary synchroscopes. Circuit and block diagrams with their main characteristics are given for some of these. J.T.Hayden

621.313.3

38 USE OF THE PRINCIPLE OF SUPER-IMPOSITION IN INVESTIGATIONS OF A.C. MACHINES. I.I.Treshchev.
Elektrichestvo, 1959, No. 9, 30-5 (Sept.). In Russian.

Investigations of the transient processes in synchronous and asynchronous machines using the standard equations present certain difficulties. Calculations can be simplified if the windings of the machine, or some of them, are considered as superconductors. In this case the principle of superimposition can be applied: each component of the currents is determined separately, and the full solution is found by adding these components together and allowing for attenuation. The conditions for the use of this principle are explained and some examples are given. Metropolitan-Vickers

621.313.3

39 AN ALTERNATOR WITH FIELD-FORM ENVELOPE CONTROL. J.W.Pannell.
Proc. Instn Elect. Engrs, Paper 3089S, publ. Dec., 1959 (Vol. 106A, 491-2).

Consideration is given to a method of waveform synthesis by changing the generated waveform envelope as an alternative to the more usual procedure in which the desired non-sinusoidal waveform is obtained by mixing selected constituent harmonics. A rotating machine is used and continuous variation of the shape of the generated waveform may be made with the machine in motion. A preliminary version of this apparatus has been constructed from a modified induction motor, but owing to the inherent heteropolar form of the magnetic circuit, this machine will synthesize only waveshapes containing the odd harmonic series. For convenience in observation and measurement a fundamental frequency of 50 c/s has been selected for the prototype, but with suitable modification of the magnetic circuits higher frequencies and also waveforms containing both odd and even harmonic series could be obtained.

621.313.3-8

40 ALTERNATING-CURRENT GENERATION IN AIRCRAFT. M.L.Moiroud.
Bull. Soc. Franc. Elect., Vol. 9, 471-88 (Aug., 1959). In French.

Explains to the conventional engineer in industry the special operating conditions of electrical equipment used in aircraft, and the consequent design problems. Reference is made to Abstr. 3924 of 1959 to account for the adoption of a.c. generation and a standard frequency of 400 c/s. Fixed-frequency alternators are heavy, difficult to maintain and expensive because of the drive, which must deliver a constant speed from a variable speed engine. Simple, cheaper and more robust is a generator driven directly from the aircraft engine, its frequency varying, but its voltage held constant with a regulator. The alternator and regulator of two French aircraft in batch production are described with circuit diagrams, also another under development, all with variable-frequency alternators. The requirements of protection are reviewed, several converters and their regulators and one type of transformer-rectifier are described with illustrations. E.F.Hansford

621.313.3-8 : 621.316.72

41 A SELF-REGULATING ALTERNATOR FOR VARIABLE SPEED SETS. R.Schmidt.
Latv. PSR Zinat. Akad. Vestis, No. 5(142), 41-9 (1959). In Russian.

The use of the self-regulating principle for a variable-speed alternator is considered. Methods of voltage stabilization in no-load conditions are suggested and an investigation of one of these methods is described. Results of self-regulating alternator testing in different load conditions are described.

621.313.32

42 THE POSSIBILITY OF INCREASING THE STATIC STABILITY LIMIT OF SYNCHRONOUS MACHINES. M.Canay.
Bull. Assoc. Suisse Elect., Vol. 50, No. 21, 1016-19 (Oct. 10, 1959). In German.

After explaining mathematically the theoretical possibilities of increasing stability, the use of the pole-angle regulator is explained. This provides an excitation proportional to the pole-angle. The action depends on the steepness of the characteristic of the regulator and it is shown that this can be calculated in advance. R.G.Jakeman

621.313.322

43 ANALYTICAL METHOD OF CALCULATING THE EXTERNAL CHARACTERISTICS OF A.C. GENERATORS WITH PERMANENT-MAGNET EXCITATION. F.F.Galteev.
Elektrichestvo, 1959, No. 8, 30-5 (Aug.). In Russian.

An accurate analytical method is given for calculating the external characteristic of a generator without the need for plotting auxiliary curves. The method consists in defining an analytical connection between the parameters of the rotor magnet diagram and those of the Blondel diagram, and in the introduction of a generalized equivalent circuit for generators with permanent magnets of any type. An example of the calculation is appended. Metropolitan-Vickers

621.313.322

44 PHYSICAL MODELLING OF THE RIGIDITY AND VIBRATION RESISTANCE OF THE STATOR FRAME OF AN ELECTRICAL MACHINE. I.D.Urusov and V.M.Podrez.
Elektrichestvo, 1959, No. 10, 43-7 (Oct.). In Russian.

The problem of modelling of a turbo-generator stator frame, which in the structural sense is by nature a complex element, is considered. The basic principles of modelling are considered: materials to use, scale, frequencies of the natural oscillations, etc. Investigations were carried out on various models of stator frames: the results are given in detail. It is shown that modelling of stator frames is a completely satisfactory method of evaluating the rigidity and vibration resistance in these elements of large turbo-generators. Metropolitan-Vickers

621.313.322-81

45 350 MW TURBO-GENERATORS FOR DRAKELOW.
Elect. Rev., Vol. 165, No. 16, 759 (Nov. 27, 1959).

Brief details are given of the 350 MW single-shaft English Electric turbo-generators to be installed at the Drakelow 'c' power station. The turbines will have steam conditions at the t.s.v. of 2300 lb/in^2 and 1050° F/1050° F reheat. The two boilers will supply steam at the rate of 2450 klb/hr. The alternator is of the direct-cooled conductor type, employing a water-cooled stator winding and a hydrogen-cooled rotor, the rated gas pressures being 45 lb/in^2. Central Electricity Generating Board Digest

621.313.322-81 : 621.316.91

46 FIELD SUPPRESSION OF TURBO-ALTERNATORS. J.R.Hill, A.Hunt, W.J.Joyce and D.H.Tompsett.
Proc. Instn Elect. Engrs, Paper 3161S, publ. Nov, 1959, 11 pp. To be republished in Vol. 107A (1960).

The paper is concerned with the field suppression of synchronous machines by means of a discharge resistor connected across the field winding and with the suitability of such a method for alternators of 100 MW and above. Expressions are given for the field current when a 3-phase fault is applied to the armature terminals, and also for the currents and voltages during field suppression. The effect of the discharge resistance value upon the field over-voltages, the field circuit-breaker arc duration and the stator fault damage is discussed. Many field suppression tests have been made on turbo-alternators in conjunction with short-circuit tests on the alternator. Results of some of these are presented and are compared with values of theoretical expressions derived as illustrated in the appendix. The duty on the main and discharge contacts of the field circuit-breaker and methods of proving their suitability for the duties are considered. The use of a synthetic circuit for proving the interrupting capacity of the main contacts is unsuitable if the arcing time is long. Other forms of field suppression are available. These may give improved field suppression but either require more complex circuits or are unlikely to be suitable for very large alternators. It is concluded that the value of the discharge resistance should be determined by the permissible field over-voltage and circuit-breaker arc duration.

621.313.322-81

47 A HYDROSTATIC THRUST-TYPE SHAFT SEAL FOR HYDROGEN-COOLED GENERATORS.

W.W.Gardner, A.Lehrkind and W.L.Ringland.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 653-9 (1959) = Pwr Apparatus Syst., No. 43 (Aug., 1959).

The essential function of a hydrogen seal is to prevent escape of hydrogen where the shaft ends pass through the machine enclosure. As shaft diameters become larger and higher hydrogen pressures are used, increasingly difficult design problems arise. Two basically different types of seal are in use, one resembling a journal bearing and the other a thrust bearing. The basic function of sealing in the thrust-type seal is accomplished by a babbitted seal face bearing on a rotating flange. In the new seal, hydrostatic rather than hydrodynamic principles are employed to maintain the oil film. To reduce the amount of air released into the hydrogen by the oil and the absorption of hydrogen by the oil the centrifugal effects of the rotating oil film are utilized to oppose and greatly reduce the flow of oil to the hydrogen side of the seal. It is anticipated that this type of seal will be suitable for use on all hydrogen cooled generators, whatever the operating gas pressure.

G.V.Hargreaves

621.313.323

48 APPLICATION OF A SELF-STARTING MINIATURE SYNCHRONOUS MOTOR AS A STEP MOTOR.

W.Renelt.
A.E G. Progress, 1958, No. 4, 331-2.

English translation of a paper already abstracted in Abstr. 3935 (1958).

621.313.325

49 HEATING OF THE ROTOR CAGE OF A SYNCHRONOUS CONDENSER DURING ASYNCHRONOUS STARTING.

N.A.Polyak.
Elektrichestvo, 1959, No. 9, 41-6 (Sept.). In Russian.

Existing methods for calculating the temperature rise in the rotor cages and their limitations are considered. In the method described, it is possible to determine the average temperature rise after completion of the starting process, in each segment of the cage, and in the short-circuiting rings. It is claimed that this method offers a fuller analysis of the thermal conditions in the rotor cage. Different cage designs are examined and the results given.

Metropolitan-Vickers

621.313.33

50 THE MOST FAVOURABLE DESIGN OF THE SHORT-CIRCUITING RINGS ON INDUCTION MACHINES.

W.Schuisky.
Elektrotech.u.Maschinenbau (E.u.M.), Vol.76, No.19, 455-6 (Oct. 1, 1959). In German.

Two types of short-circuiting ring for squirrel-cage rotors are compared and equations are developed for calculating the mechanical stress in the rotor bars due to the thermal expansion of the rings during motor starting or during manufacture. On the basis of a numerical example, it is concluded that a band that is brazed to the rotor bar ends is superior to a band which is fitted underneath the projections of the rotor bars. H.Sterling

621.313.332-82

51 WATER-TURBINE-DRIVEN INDUCTION GENERATORS. C.L.C.Allan.
Proc. Instn Elect. Engrs, Paper 3140S, publ. Dec. 1959, 15 pp. To be republished in Vol. 107A (1960).

Outlines the main differences between motor and generator operation and considers the excitation of generators, in particular when provided by system capacitance. Results are given of tests on machines to ascertain the practical effects of uncontrolled excitation and switch-in currents. Information is given about some advantages arising from the absorption of reactive current produced by long transmission lines and the reduction in voltage drop on lines delivering power. The equipment necessary for control, protection, starting and synchronizing is described, as well as technical matters concerned with drying out windings and checking phase rotation. Three typical schemes are described and a list of existing and planned installations is given. An Appendix deals in more detail with the theoretical values of the equivalent circuit, torque and power factor, as well as circle diagrams.

621.313.333

52 THE MECHANICAL CHARACTERISTIC OF A THREE-PHASE INDUCTION MOTOR WITH ASYMMETRICAL STATOR CIRCUIT. L.I.Stolov.
Elektrichestvo, 1959, No. 10, 47-50 (Oct.). In Russian.

621.313.333

53 THE MAGNETIC POTENTIAL IN THE ROTOR BACK-IRON OF ASYNCHRONOUS MACHINES. K.Oberreti.
Elektrotech.u.Maschinenbau (E.u.M.), Vol.76, No.19, 449-54 (Oct.1, 1959). In German.

The calculation of the rotor back-iron m.m.f. for induction motors is discussed in detail, with special reference to two-pole machines. It is shown that axial ventilation holes can be the cause of objectionable current fluctuations at low values of slip, i.e. near no load. Equations and curves for the calculation of the flux distribution and shaft eddy-current losses of loaded and unloaded motors are presented. The reduction in rotor yoke flux-density due to flux penetrating into the shaft results in a shifting of the neutral axis and in eddy currents in the shaft, which will cause the motor to accelerate, even if the rotor winding is open circuited. H.Sterling

621.313.333 : 621.316.318

54 THE LOGMOTOR — A CYLINDRICAL BRUSHLESS VARIABLE-SPEED INDUCTION MOTOR.

F.C.Williams, E.R.Laithwaite, J.F.Eastham and L.S.Piggott.
Proc. Instn Elect. Engrs, Paper 3149 U, publ. Feb., 1960, 10 pp. To be republished in Vol. 108 A (1961).

In a conventional induction motor the synchronous speed at the rotor surface is set by the phase difference between currents in adjacent slots and the spacing of the slots. The synchronous speed may be increased by changing the phase of the current in each slot progressively so as effectively to stretch the poles. A transformer arrangement giving a multi-phase output is described which can provide such a "phase-stretching" system to be used to supply the stator of a squirrel-cage induction motor. The transformer is similar to a conventional phase-shifting transformer, except that the pitch of each coil of the primary is proportional to the log of its distance from a fixed point in the system. The primary and secondary of the transformer are analogous to the C and D scales of a slide-rule, and movement of the primary relative to the secondary results in a variation of the phase increment between adjacent secondary coils. The secondary is connected to the stator winding of the motor in such a way as to provide a uniform-velocity field in the latter, the velocity being varied by adjusting the position of the primary of the transformer. The method of construction of an experimental machine is described and test results over a speed range of 4 : 1 are included.

621.313.333

55 DEVELOPMENT AND DESIGN OF SPHERICAL INDUCTION MOTORS.

F.C.Williams, E.R.Laithwaite and J.F.Eastham.
Proc. Instn Elect. Engrs, Paper 3036U, publ. Dec., 1959 (Vol. 106A, 471-83).

The first major development described is concerned with the arrangement of stator blocks. A previous paper described a system in which four stator blocks were arranged around the rotor. The new layout involves the use of only two blocks containing pre-skewed slots. The arrangement of the laminations and slotting is such that the two blocks can be rotated as a unit to produce speed adjustment. This arrangement is shown to produce a more uniform effective

field velocity over the active surface of the stator. It equalizes the magnetic pull between rotor and stator and has several other design advantages which are fully discussed. The earlier theory of the spherical motor is extended to the case of machines with pre-skewed slots. Test results obtained from several experimental machines are shown. In the light of these results a procedure for designing spherical motors is developed. Several aspects concerning manufacturing procedure, such as the required numbers of rotor bars and rings, have been investigated, and the practical results of these tests are included. A short section of the paper is devoted to the performance of spherical machines when used as induction generators.

621.313.36-9

56 BRUSH NOISE IN MINIATURE SINGLE-PHASE COMMUTATOR MOTORS. N.V.Astakhov.
Elektrichestvo, 1959, No. 9, 46-50 (Sept.). In Russian.

Expressions are obtained, on the basis of familiar equations for radial oscillations in brushes, which make it possible to evaluate the effect of certain factors such as angle of inclination of the brush-holder and pressure on the brush, on brush noise. Various suggestions are made, with regard to design, for improving the noise characteristics. Metropolitan-Vickers

621.313.36-9

57 ABOUT THE COMMUTATION ON UNIVERSAL MOTORS. A.W.Mohr.
Elektrotech. u. Maschinenbau (E.u.M.), Vol. 76, No. 19, 456-60 (Oct. 1, 1959). In German.

Starting from the differential equation of a.c. commutation and using brush potential curves obtained from test results under operating conditions, the limits of commutation are obtained graphically. Conditions for satisfactory commutation are established and a numerical example illustrates the application of the method.

H.Sterling

621.313.36-9

58 RECENT DEVELOPMENTS IN THE FIELD OF N–S [COMMUTATOR] MOTORS. J.C.H.Bone.
L.S.E. Engng Bull., Vol. 5, No. 2-3, 1-20 (Sept., 1959).

A review of the developments of this type of stator-fed motor, which can now be built in the 5000 to 10 000 h.p. range. The principal features are the damping winding underneath the commutator winding and the use of a double or single induction regulator. The theory is explained and many illustrations included.

R.G.Jakeman

621.313.822

59 TWO EXAMPLES OF THE APPLICATION OF FERROXDURE IN SMALL D.C. MOTORS.
J.de Jong and M.F.Reynst.
Matronics, No. 16, 305-11 (Aug., 1959).

Describes two motors using ceramic permanent-magnet rotors, the first for a wind-screen wiper and the other for a heater ventilator.

TRANSFORMERS

621.314.2

60 THE COOLING OF TRANSFORMERS. K.Niederhoefer.
A.E.G. Progress, 1958, No. 4, 273-83.

English translation of a paper already abstracted in Abstr. 2375 (1958).

621.314.2

61 MECHANICAL AND THERMAL PROTECTION OF TRANSFORMERS. L.Libert.
Bull. Soc. Belge Elect., Vol. 75, No. 3, 211-21 (July-Sept., 1959). In French.

A review of modern practices, considered under four headings: (a) protection of oil, by use of hermetically sealed transformers, conservators with drying breathers, various forms of nitrogen and flexible diaphragm seals, and by use of inhibitors; (b) Buchholz relay protection against internal faults; (c) methods of protection against failures of auxiliaries such as fans and oil pumps; and (d) thermal protection. This section includes a summary of temperature relationships between various points in a transformer and then considers the use of thermal images, and of thermal relays for protection during periods of greater-than-normal loading.

M.R.Dickson

621.314.2

62 RELIABILITY OF TRANSFORMERS FOR ELECTRONIC APPLICATIONS. O.L.Angevine, Jr.
Elect. Engng, Vol. 78, No. 9, 918-20 (Sept., 1959).

A programme is proposed which aims at reliability in every step of transformer design and production. Possible errors in the specification are described, and the establishment of standard design limits and safety factors is recommended. Transformers should be approval-tested to failure in the specified environment to give proof of a safety factor between specification limits and the pattern of failure. After examination of a completed equipment, specification requirements should be reviewed by the designer. The design and production process throughout should be performed by personnel dedicated to reliability, and never given any other class of work. Standard quality control records should be made available by transformer manufacturers to their customers, and the causes of field failures should be reported in greater detail. 10 references.

E.F.Hansford

621.314.2

63 COOLING OF LARGE POWER TRANSFORMERS. G.O.Castell.
Elect. Rev., Vol. 165, No. 16, 729-32 (Nov. 27, 1959).

Reference is made to the penalties of excessive temperature rise and the location of high temperatures within a transformer. The methods currently employed using both natural and forced oil and air circulation for cooling large units are surveyed.

Central Electricity Generating Board Digest

621.314.2

64 A.C. TRANSFORMERS WITH ADJUSTABLE MAGNETIZING CURRENT. W.Krämer.
Elektrotech. Z. (E.T.Z.) A, Vol. 80, No. 14, 441-5 (July 11, 1959). In German.

For an a.c. transformer free of harmonics and having d.c. pre-magnetization for changing the magnetizing current, a core composed of partial cores is put forward as the best form of construction. Pre-magnetization and compensation of harmonics can be carried out in separate coils or in a common winding. Characteristics of series- and parallel-connection are investigated, and results of tests on models reported. Data are given on the design of a 30 MVA transformer with adjustable magnetizing current, and the variation of pre-magnetization with time is shown.

621.314.2

65 REGULATIONS ON THE CONSTRUCTION AND TESTING OF H.V.-TRANSFORMERS FOR SPECIAL PURPOSES. W.Reiche.
Elektrotech. Z.(E.T.Z.) A, Vol. 80, No. 14, 449-53 (July 11, 1959). In German.

The article gives views on the design and testing of h.v. transformers for special purposes. In principle, they should be constructed and tested (in Germany) in accordance with the V.D.E. Regulations. The test voltage proposed is double the rated voltage for transformers for continuous operation, and for those for intermittent operation 1.35 times, provided this is not higher than 100 kV approximately. In exceptional cases, such as some X-ray transformers, a reduction of the test voltage accompanied by an extension of the test period must be accepted.

621.314.2 : 621.316.93 : 621.317.333.82

66 THE SELECTION OF INSULATION LEVELS AND TESTS FOR HIGH-VOLTAGE TRANSFORMERS. G.B.Harper.
Proc. Instn Elect. Engrs, Paper 2804S, publ. Jan., 1959 (Vol. 106A, 429-44).

Republication with discussion of the paper abstracted in Abstr. 1331(1959).

621.314.2.07

67 AN OPTIMUM RATIO OF COPPER LOSSES AND IRON LOSSES FOR A TRANSFORMER WITH VARIABLE LOAD. G.S.Brosan and D.O.Bishop.
Proc. Instn Elect. Engrs, Monogr. 348S, publ. Nov., 1959, 2 pp. To be republished in Part C.

When a power transformer is loaded so that it is operating at maximum efficiency the copper losses are equal to the iron losses. The "efficiency" is, of course, the "power efficiency", i.e. the ratio of output power to input power. The same condition applies for maximum "energy efficiency" only if the load is constant for the period being considered. With most transformers the load varies considerably over a load cycle and the optimum ratio of copper losses to iron losses calculated on the assumption of constant load for a given period can only be, at least, a rough approximation. A method is suggested

of obtaining a more accurate optimum ratio in cases where the load variation of the transformer can be estimated in advance. The assumption is made that the copper resistance is constant.

621.314.212

68 PROTECTION OF TRANSFORMERS AGAINST FIRE. J.Baclet.

Bull. Assoc. Suisse Elect., Vol. 50, No. 14, 685-93 (July 4, 1959). In French.

Investigations into transformer fires in France have led to conclusions as to the way fires usually break out and how they develop. Recommendations are made for tank design to minimize opportunities of fire propagation, and for protection of the transformer by fire protecting layouts and equipment. A type of fire-extinguishing equipment has been developed and is described in detail. When a fire breaks out, the transformer oil level is rapidly dropped below tank-lid level, and nitrogen under pressure is passed into the bottom of the tank. The vigorous stirring action of this gas soon cools the oil at the points where it is burning to below the temperature necessary to support combustion (180°C). M.R.Dickson

621.314.213

69 A 10 000-kVA GAS-INSULATED TRANSFORMER — A PROGRESS REPORT. G.Camilli.

Elect. Engng., Vol. 78, No. 8, 828-30 (Aug., 1959).

The core and coils of this unit are of orthodox construction, insulated with class A material; they are enclosed in a cylindrical tank, filled with SF_6 at a pressure of 15 lb/in^2 above atmospheric at 25°C. A fan circulates the gas through the windings and over a heat exchanger inside the tank; Freon is used in a secondary circulation to transfer heat from the heat exchanger to an external fan-cooled condenser. Designed values of mean winding temperature rises are 55°C but higher values are envisaged for future units; overload capacities are stated to be approximately the same as forced-oil-cooled transformers. The noise level for core plus fans is 8 dB lower than an equivalent fan-cooled oil-filled unit of the same rating; this is claimed to be because the gas filling is a poor transmitter of vibration. M.R.Dickson

621.314.214

70 THE OPERATION OF REGULATING TRANSFORMERS IN PARALLEL. H.Christl.

Österr. Z. ElektWirtsch. (Ö.Z.E.), Vol. 12, No. 10, 528-31 (Oct., 1959). In German.

A graphical method is developed to determine the unbalanced loads caused by a difference in the tappings of 2 transformers in parallel. Numerical examples are given. R.G.Jakeman

621.314.214.2

71 THE INDUCTION REGULATOR: ITS PRINCIPLES AND INDUSTRIAL APPLICATIONS. K.K.Schwarz.

L.S.E. Engng Bull., Vol. 5, No. 2-3, 21-30 (Sept., 1959).

A review of the principles and applications of the single and double induction regulator for equipments up to 5000 kVA. Typical applications are for line-voltage control; heater equipments; slip-ring frequency convertor; phase-shifter; automatic p.f. correction A bibliography is added. (See also Abstr. 58).

R.G.Jakeman

POWER CONVERSION

621.314.5

72 DESIGN OF TRANSISTOR POWER CONVERTERS. T.R.Pye.

Electronics, Vol. 32, No. 36, 56-8 (Sept. 4, 1959).

Transistor convertors are more reliable than rotary convertors or types incorporating vibrators. They are used to provide plate supplies from l.v. batteries, or to feed fluorescent lighting, electronic photoflash and servo systems. Their efficiency can be 70-90%, input voltages 1.5 to 50 V and power outputs up to several hundred watts, the voltage and output being increased by series or parallel connection of the transistors. The voltage, dissipation and impedance characteristics required in the transistors are described. At power levels below 1 W a ferrite-core transformer operating at a frequency of several kilocycles is preferable; above this output nickel–iron cores are used at frequencies from 200-800 c/s. The design method for the transformer is outlined. Two typical convertor designs are given in detail, both operating from 24 V input, one using Si transistors to give 15 W output, the other using Ge transistors to give 100 W output. E.F.Hansford

621.314.6 : 621.375.9

73 SUPERCONDUCTING RECTIFIER AND AMPLIFIER. J.L.Olsen.

Bull. Inst. Internat. Froid, Annexe 1958-1, 91-4.

Currents of up to 250 A in liquid helium were obtained without the use of thick leads by means of a superconducting tranformer and rectifier-amplifier. The low-voltage secondary current passes through a coil driven into the intermediate state at the current peak of each cycle: the coil is biassed by a magnetic field to give rectification. Suitable materials and design details are described. R.C.Kell

621.314.62

74 MECHANICAL RECTIFIERS FOR HIGH D.C. VOLTAGES FOR SUPPLYING LARGE ELECTROLYTIC PLANTS. G.Reinhardt.

A.E.G. Progress, 1958, No. 4, 293-300.

English translation of a paper already abstracted in Abstr. 2839 (1958).

621.314.63

75 TRANSISTOR RECTIFIER GIVES D.-C. OF EITHER POLARITY. R.R.Bockemuehl.

Electronics, Vol. 32, No. 25, 76 (June 19, 1959).

Outlines an arrangement in which two emitter-followers feed d.c. power in opposite directions into a common load from separate d.c. sources, the magnitude and sign of the resultant power in the load being continuously variable by means of a bias voltage applied between the bases of the two transistors. F.F.Roberts

621.314.63 : 621.382.2 : 621.316.91

76 THE CHARACTERISTICS AND PROTECTION OF SEMICONDUCTOR RECTIFIERS. D.B.Corbyn and N.L.Potter.

Proc. Instn Elect. Engrs, Paper 3135U, publ. Nov. 1959, 14 pp. To be republished in Vol. 107A (1960).

Describes the probable sphere of application of monocrystalline semiconductor rectifiers and states the problems which must be solved to ensure reliable operation under both normal and abnormal conditions. The basic characteristics of these rectifiers are then discussed. A brief description is given of the special test methods required to establish the characteristics, and it is shown that important properties can be entirely overlooked if test methods are inadequate. Operating conditions are examined under both normal conditions and during faults and overloads, and the protection requirements are deduced. The properties of h.r.c. fuses are briefly discussed, and by consideration of the rectifier properties and operating conditions the requirements are stated for the special fuses necessary. It is shown that these special fuses provide a basis for a protective system which enables full use to be made of the new semiconductor rectifiers. Concludes with a description of the practical application of these special fuses, and shows how different forms of protection can be coordinated to ensure satisfactory operation of semiconductor rectifiers under different conditions for a wide variety of duties.

621.314.63

77 SILICON CONTROLLED RECTIFIER—TRIGGERING AND TURN-OFF CIRCUITRY FOR INVERTER APPLICATIONS. D.V.Jones.

I.R.E. WESCON Convention Record, Vol. 3, Pt 6, 122-8 (1959).

After stating the requirements for triggering a silicon controlled rectifier (s.c.r.) for inversion, including the problem of firing s.c.r's connected in parallel, the operation of two triggering circuits is described in detail with circuit and waveform diagrams. Six basic turn-off circuit diagrams are given, and the conditions are discussed for achieving a faster recovery time for the s.c.r. The use of a basic parallel invertor circuit to measure the turn-off time of an s.c.r. is described and a final circuit outlines an s.c.r. invertor in which load power-factor variations do not affect the turn-off time. Both the triggering and turn-off circuitry may be applied to many different applications. E.F.Hansford

621.314.63 : 621.382.23

78 DESIGN CONSIDERATIONS IN THE DEVELOPMENT OF SILICON POWER RECTIFIERS. D.Fishman, H.C.P.Kinge and J.G.Litterick.

Proc. Instn Elect. Engrs, Paper 3099 E [International Convention on Transistors and Associated Semiconductor Devices], publ. 1960 (Part B Suppl. No. 15, 419-25).

The techniques used in the design and preparation of silicon rectifier diodes intended for use in medium- and high-power conversion equipment are discussed. It is shown that the designer has a certain degree of freedom, but that there are likely patterns for the configuration of future rectifier structures. The fact that a large part of the problem springs from thermal considerations is stressed. No attempt is made to deal with the physics of semiconductor behaviour or p–n junction theory, as this has been adequately dealt with elsewhere.

621.314.63

79 THE PARALLEL AND SERIES OPERATION OF GERMANIUM RECTIFIERS. H.S.Blanks.

Proc. Instn Radio Engrs Australia, Vol. 20, No. 7, 406-12 (July, 1959).

Permissible ratings of Ge rectifiers operated in series and parallel connections have been calculated for the cases where load balancing resistors are placed in parallel and in series, respectively, with the individual rectifiers.

621.314.632

80 INVESTIGATION OF LARGE GERMANIUM RECTIFIERS.

V.S.Bagaev, B.M.Vul, A.A.Zherebtsova and S.B.Yuditskii.

Elektrichestvo, 1959, No. 10, 21-6 (Oct.). In Russian.

Results are presented of investigations into large germanium rectifiers of a specific type. The authors examine: forward current as functions of voltage and temperature; saturation current; capacitance; and inverse branches of the V-I characteristic. Full details are given of the investigations and their results. It is shown that in most cases there is good agreement between experimental and theoretical data. Metropolitan-Vickers

621.314.65 : 621.318.42

81 THE DESIGN OF ANODE CURRENT DIVIDERS. V.M.Razin, I.P.Chuchalin and V.A.Kochegurov.

Elektrichestvo, 1959, No. 8, 54-7 (Aug.). In Russian.

The operation of a three-anode current divider is analysed on the assumption that the voltage drop in the valve is independent of the anode current, that the resistances of the divider windings and energy losses in its core, the effects of divider and valves on the performance of the main circuit, and magnetic leakage between the windings, are negligible. The latter can be obtained by zig-zag windings or by providing air-gaps in the cores of the windings.

Electrical Research Association

621.314.67

82 ARTIFICIAL COMMUTATION IN SINGLE-PHASE RECTIFIERS. B.A.Metelkin.

Elektrichestvo, 1959, No. 7, 19-21 (July). In Russian.

The correction of low power factor in locomotive rectifier installation is intended. The commutating point in a centre-tapped system is advanced by an auxiliary rectifier cooperating with a series capacitor and a parallel reactor. With low efficiency $\cos \varphi = 1$ is approached. Trial runs prove the system economical. The method of obtaining the dimensions of auxiliary equipment is given. P.Szekely

POWER TRANSMISSION
OVERHEAD LINES . CABLES

621.315.1

83 THE TECHNIQUE OF ELECTRICAL ENERGY TRANSMISSION. NOTES FOR 1958. L.Paris.

Elettrotecnica, Vol. 46, No. 7, 404-13 (July 10, 1959). In Italian.

A general review of developments above 220 kV, referring to an extensive bibliography (not published). Insulation level, tower construction and line material are discussed. P.Linton

621.315.14

84 PROPAGATION OF SINUSOIDAL OSCILLATIONS ALONG A HORIZONTALLY SPACED THREE-WIRE LINE.

M. V. Kostenko.

Elektrichestvo, 1959, No. 8, 1-8 (Aug.). In Russian.

Represents the first attempt to examine the wave process in a multiwire line on the basis of solving the electromagnetic field equation without using equations of equivalent electric circuits. The evaluation shows that for a wave in an asymmetrical wave channel (0-Channel) the calculation error does not exceed 10%, which is tolerable for practical purposes.

Central Electricity Generating Board Digest

621.315.145

85 BUNDLED CONDUCTOR VOLTAGE GRADIENT CALCULATIONS. J.Reichman.

Trans Amer. Inst. Elect. Engrs III, Vol. 78, 598-607 (1959) = Pwr Apparatus Syst., No. 43 (Aug., 1959).

Covers calculations for e.h.v. lines using 2-, 3-, and 4-conductor bundles. The results are presented in graphical form so that bundled conductor designs, for a specified voltage gradient at line voltages up to 500 kV, can easily be obtained.

621.315.17

86 INTRODUCTION TO THE RECOMMENDATIONS FOR THE COORDINATION, DIMENSIONING AND TESTING OF THE INSULATION OF HIGH-VOLTAGE TRANSMISSION LINES. H.Kliy.

Bull. Assoc. Suisse Elect., Vol. 50, No. 20, 969-72 (Sept. 26, 1959). In French.

Review of the main details and the tests on which they are based. The effect of ground slope on the protection afforded by an earth wire is discussed. Flash-over characteristics of insulators and surge diverters are compared under surge conditions. P.Linton

621.315.17

87 330 kV TRANSMISSION SYSTEMS. Yu.L.Gryuntal' and A.N.Sherentsis.

Elektrichestvo, 1959, No. 9, 13-20 (Sept.). In Russian.

The characteristics and future prospects for 330 kV transmission systems in the U.S.S.R. are examined. Such systems are necessary for transmitting power over distances for which a 220 kV system would be inadequate and a 500 kV system uneconomical. Sections are included on insulation level, insulation of the transmission lines, corona losses, basic characteristics, technical–economic factors, range of application and future prospects. Metropolitan-Vickers

621.315.17

88 MUSKEG NEEDS SPECIAL TOWER FOOTINGS. J.O.Tonning.

Elect. Wld, Vol. 151, No. 26, 94-5 (June 29, 1959).

Muskeg, a mixture of decayed vegetable matter, mud and silt, posed difficult problems for the construction of a 138 kV transmission line. Conventional foundations proved impracticable or too costly. The problem was solved by using winter concreting technique. The foundation consisted of a four-legged, two-way rigid frame with circular legs which could be poured in steel forms when the frozen muskeg had been augured through. The legs were carried down to solid bearing strata. A.P.Wilmshurst

621.315.17

89 CONSIDERATION OF THE FAULT RESISTANCES IN DOUBLE PHASE-TO-EARTH SHORT-CIRCUITS. P.K.Feist.

Elektrichestvo, 1959, No. 8, 22-5 (Aug.). In Russian.

In equivalent circuits for the calculation of this type of fault, the fault resistances between phases and earth are usually taken as equal, whereas this is generally not the case in actual faults. Methods of solving such problems of a strongly asymmetrical character exist and their solution is rendered much more convenient by using the compensation theorem. The working is explained and illustrated by a numerical example.

Electrical Research Association

621.315.2

90 SPACE ELECTRIC POWER TRANSMISSION. G.W.Bills.

Elect. Engng, Vol.78, No.10,1021-4 (Oct., 1959).

To provide shielding for crews of manned space vehicles utilizing nuclear sources, considerable distance between the power source and vehicle may be necessary. Some of the problems involved in the design of the required transmission line are discussed.

621.315.2 : 621.315.61

91 GASEOUS DISCHARGE PHENOMENA IN HIGH-VOLTAGE D.C. CABLE DIELECTRICS. E.C.Rogers and D.J.Skipper.

Proc. Instn Elect. Engrs, Paper 3144S, publ. Jan., 1960, 10 pp. To be republished in Vol. 107A (1960).

Considerations of the short-time electric strength and of the conductivity/temperature/stress relationships show that both impregnated paper and polythene are likely to be satisfactory dielectrics for use in h.v. d.c. cables. From a.c. experience, however, it is known that polythene in particular is very vulnerable to damage caused by discharges in gas-filled cavities, and an assessment of the importance of this mode of deterioration under d.c. conditions is therefore necessary. Calculations have been made of the repetition

rate of discharges in a gas-filled cavity in a dielectric subjected to a d.c. stress, since this is clearly a decisive factor determining the rate of deterioration. The repetition rate is shown to be a maximum when the surface conductivity of the dielectric is zero. Direct measurements of the repetition rate of discharges are described, and the measured rates are shown to be consistent with the calculated maximum rates. The effects of ripple voltages and polarity reversals are considered. From the predicted discharge repetition rates and from the results of accelerated life tests on samples containing cavities, a rough estimate of the effect of discharges on the probable life of an h.v. d.c. cable dielectric can be made. Polythene was selected as the example for study, on account of its known vulnerability to discharges, and it is shown that, with this material, discharge damage is unlikely to be a serious problem under d.c. conditions, provided that ripple voltages are not excessive and that very frequent reversals of polarity can be avoided.

621.315.21

92 FLEXURAL NOISE IN CABLES. R.A.Rasmussen.

Bell Lab. Record, Vol. 37, No. 8, 305-8 (Aug., 1959).

Describes a device for measuring and comparing the noise levels caused by flexing various types of cables. The samples are immersed in a conducting fluid whose pressure is caused to pulsate by means of a cam-driven piston. Displacement currents are amplified and displayed. V.G.Welsby

621.315.211

93 GEOMETRICAL DIMENSIONS AND DIELECTRIC STRENGTH OF THE INSULATION OF SECTOR-TYPE CORES. V.P.Shevchenko-Vinogradov.

Elektrichestvo, 1959, No. 8, 69-72 (Aug.). In Russian.

The use of sector-type cores in place of round ones in three-phase power cables for 1 to 10 kV reduces the cross-section of the cable and the corresponding quantity of materials used in their manufacture. However, because of the irregular dimensions of the sector-type core, calculations for different voltages and different types of insulation are more complicated than for round cores. A method of calculation is suggested, which makes it possible to determine, accurately and simply, the necessary dielectric strength of the cable insulation and the minimum quantities of material required in their manufacture. Metropolitan-Vickers

621.315.21 : 621.315.614 : 621.317.333

THE IMPULSE STRENGTH OF IMPREGNATED-PAPER DIELECTRICS AS USED IN HIGH-VOLTAGE CABLES. See Abstr.157

621.315.211.3

94 HIGH-VOLTAGE OIL-FILLED CABLES.

Elect. Rev., Vol. 165, No. 15, 686-8 (Nov. 20, 1959).

The 330 kV oil-filled cables installed at the TI power station of the Snowy Mountains Hydro-Electric Authority are described. The cable design is discussed and particulars are given of the type tests to which it has been successfully subjected. A general description of the installation work undertaken in Australia is included.

Central Electricity Generating Board Digest

621.315.221.8

95 WEATHERING OF PLASTICIZED P.V.C. FOR THE CABLE AND CONDUCTOR INDUSTRIES. W.Birnthaler and G.Falk.

Kunststoffe, Vol. 49, No. 9, 439-46 (Sept., 1959). In German.

The brittle temperature of weathered strips of plasticized polyvinyl chloride was measured under the impact of a steel cylinder on a coiled length of strip. It was found that the influence of weathering could be made small by proper selection of plasticizers and addition of pigments, such as soot. Thermal stressing by rolling p.v.c. sheet for 40 min at 165°C. led to a more rapid increase in brittle temperature. R.Schnurmann

621.315.28

96 THE ÖRESUND POWER CABLE OF 1958. A.Bergman, W.Carlshem and G.von Geijer.

Elteknik, Vol. 2, No. 8, 121-6 (Oct., 1959).

Description of construction and installation of a 3-core, 120 MVA oil-filled cable, the submarine portion is 700 m long with a maximum depth of 35 m. V.G.Welsby

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INSULATORS
SUPPORTS . CONNECTIONS

(See also Insulating Materials)

621.315.62

97 EFFECTS OF POLLUTION ON H.V. INSULATOR PERFORMANCE. M.P.Varshney.

Elect. Times, Vol. 136, 27-30 (Aug. 13, 1959).

The problem of flashover tests on polluted insulators is reviewed under the headings, direct, semi-direct, and indirect tests. An indirect test involving spraying of clean insulators with water of different resistivities, and based on the work by H.Josse (see Abstr. 2699 of 1959) is proposed for inclusion in the standard acceptance tests. E.M.Dembinski

621.315.62

98 THE MECHANICAL STRENGTH OF PORCELAIN BODIES AND ITS VARIATION WITH DIMENSIONS. H.Barthelt and D.Weyl.

Elektrotech. Z.(E.T.Z.)A, Vol. 80, No. 14, 445-9 (July 11, 1959). In German.

Variation of the tensile, bending and breaking strength of bodies made from hard porcelain, with their diameter, length and profile was determined, the ends of the test pieces being clamped in such a way that the strength of the material was reached in each case. It was found that the strength figures fell considerably less steeply with increasing diameter than was to be expected from data in the literature. If the effects of diameter, lever arm and profile are taken into account, the breaking strength of insulators is as high as the bending strength, if the size of the clamping position is adequate. The scatter, the variation of strength with dimensions of the test piece, and the deviation of the point of initiation of the break from the theoretical position, are all due to statistical distribution of molecular areas of differing bond strength.

621.315.62

99 THE INSULATORS OF OUTDOOR ELECTRICAL INSTALLATIONS AND THE POLLUTED ATMOSPHERE. E.Dvořáček.

Energetika (Prague), Vol.9, No.9, 440-3 (1959). In Czech.

Dust from insulators is collected and dissolved in rain water. The electric resistivity of this electrolyte is indicative of the grade of pollution. Surroundings are classified into four groups according to the magnitude of the resistivity. Flashover test results as function of resistivity are given. Proposals for testing insulators under conditions of dew, fog, drizzle and thaw are given. N.Klein

621.315.626

100 THE PROTECTION OF 11 kV AND 33 kV BUSHINGS FROM DAMAGE BY ARCS IN STILL AIR AND IN A WIND. A.E.Guile.

Rep. Brit. Elect. Res. Assoc., Rep. O/T20, 11 pp (1958).

Describes the second stage in an experimental investigation carried out to determine the effectiveness of arcing devices in protecting high-voltage insulators and bushing shields. For the first stage of the investigation see Abstr. 6188 of 1958.

621.315.62 : 621.396.823

RADIO INTERFERENCE FROM H.V. INSULATORS. See Abstr. 482

621.315.668.1

101 THE PREVENTION OF INTERNAL DECAY IN CREOSOTED BALTIC REDWOOD POLES.

Rep. Brit. Elect. Res. Assoc., Rep. O/T17A, 3pp.(1958).

Illustrates in photographic form the results of correct and incorrect practice in creosoting wood poles. It emphasizes the need for careful selection, seasoning and creosoting, carried out under the supervision of a qualified inspector.

621.315.683.049.75

102 AN ANALYSIS OF PRINTED WIRE CONNECTORS. D.R.Sheriff.

I.R.E. Nat. Convention Record, Vol. 7, Pt 6, 191-203 (1959).

Consists of basic design information relating to printed wire connectors. The ideal connector is deemed to be one that includes the following features: (1) loading and operating pressure independently optimized (for stable low resistance); (2) contact electrical design independent of contact pressure spring; (3) high contact pressure (during operation only); (4) high contact stability (area and pressure); (5) automatic compensation for circuit board dimensions

and flatness; (6) larger contact area (low resistance and wear); (7) high pressure moisture and dust seal (to minimize contamination); (8) low insertion and withdrawal force (dual pressure - high operating and low loading); (9) air voids and moisture traps practically eliminated (elastomer envelops contact and mating surface); (10) overstress of contact eliminated (adjusted to board with independent load spring in addition to gauging); (11) minimum susceptibility to abuse (recessed contacts and no pins); (12) circuit itself used as part of connector (reducing total number of connections); (13) contacts wiped clean immediately prior to contact engagement; (14) larger damping with inherently non-resonant materials; (15) contact of solid non-corrosive metal alloy (solderability and minimum film resistance); (16) wear of foil minimized (contact stability, dual pressure); (17) high volume and weight efficiency. Means of attaining these features are discussed and a comparative table and graphs are included. H.A.Miller

DISTRIBUTION . INSTALLATIONS

621.316.11 : 681.142

103 THE LOGICAL DESIGN OF ELECTRICAL NETWORKS USING LINEAR PROGRAMMING METHODS.

U.G.W.Knight.

Proc. Instn Elect. Engrs, Paper 3138S, publ. Dec., 1959, 9 pp. To be republished in Vol. 107A (1960).

The results of an investigation into the mathematical design, as distinct from analysis, of electrical power-system networks are described. Starting with geographical positions of the substations which it is required to interconnect, it is shown that a set of equations can be obtained which are solvable by linear-programming techniques to obtain a minimum-cost network design. Any security of supply conditions considered necessary can be incorporated into the design equations. Solution of the resulting linear programmes requires the use of a digital computer; the necessary computer size, and amount of computation, increases rapidly with increase in the number of substations to be interconnected. With this in mind, suggestions for increasing the size of problem solvable on a given computer are made. Three designs have been completed using the method proposed. These and the results of network-analyser studies on two of them are summarized. The equations for two other possible network-design criteria, minimum circuit length and minimum apparent-power by distance product, are also given and briefly commented upon.

621.316.13

104 VOLTAGE DROP ON A.C. SYSTEMS. N.Barnes.

Elect. Times, Vol. 136, 153-4 (Sept. 3, 1959).

In the calculation of voltage drop on a supply system network there are two variables which affect the result, load and length of conductor. For a given system voltage and in the case of a.c. systems, for a given power factor also, the product of load and conductor length is a constant for the same voltage drop. On a.c. systems this product may be expressed in kVA-yd units and a table compiled which will give the kVA-yd constant at a specified power factor for various sizes of cable for one volt drop per phase. The use of this quantity gives a simple solution with reasonable accuracy for practical problems which otherwise could be derived only at great length. Several examples are evaluated. G.V.Hargreaves

621.316.13

105 LOSSES AND VOLTAGE VARIATIONS IN DISTRIBUTION NETWORKS. N.K.Arkhipov.

Elektrichestvo, 1959, No. 9, 25-9 (Sept.). In Russian.

621.316.15

106 240-VOLTS-TO-NEUTRAL SHOULD BE PREFERRED FOR UTILIZATION.

A.S.Anderson, C.Hutchinson and S.J.Pearson.

Trans Amer. Inst. Elect. Engrs III, Vol. 78, 252-65 (1959) = Pwr Apparatus Syst., No. 42 (June, 1959).

Excessive weight of copper required in conductors to meet air-conditioning loads has led to dissatisfaction with the standard American 120/208 V domestic supply and to investigation into alternative higher voltage systems. During the war a 265/460 V supply was widely used for new factories and there has been a tendency for this to be adopted also for large residential and commercial buildings. It is argued that this system is not really suitable for domestic supply and the immediate introduction of a new standard supply voltage of 240/416 V is suggested. The main points are: (1) existing domestic equipment can easily be modified to operate on 240 V. Use of 265 V is likely to call for transformers on customers' premises, not only during transitional period, but indefinitely: (2) a 265 V system would be a departure from recognized practice in most other countries: (3) difficulty in converting existing equipment to 265 V operation would lead to perpetuation of demand for obsolescent 120 V supply. D.R.Way

621.316.17 : 681.142

107 THE DESIGN OF HOUSING-ESTATE DISTRIBUTION SYSTEMS USING A DIGITAL COMPUTER.

R.L.Grimsdale and P.H.Sinclare.

Proc. Instn Elect. Engrs, Paper 3131S, publ. Nov. 1959, 11 pp. To be republished in Vol. 107A (1960).

An automatic method for designing housing-estate distribution systems is described which offers a practical and economical alternative to present design techniques. Substation positions and feeding arrangements are calculated instead of being determined intuitively, resulting in better layouts and closer approaches to given engineering limits. The method was applied to four housing estates and achieved savings ranging from 6 to 15% of the m.v. mains expenditure required by the previous manual designs. Apart from capital savings, uniform standards of design are obtained and designers are relieved of much tedious work. The automatic method can facilitate management decisions by supplying cost figures for variations in design. For example, alternative substation sites may be tested when optimum sites are difficult to secure, the cost of increase in assumed a.d.m.d. can be determined and variations in the number of standard cable sizes can be investigated. Special features of the automatic method are the division of irregular estate areas and a road-selection procedure which determines the shortest route between two points.

621.316.35

108 THERMAL CONTROL OF THE PERMISSIBLE LOAD OF BUSBARS. Z.Křesadlo.

Elektrotech. Obzor, Vol. 48, No. 9, 458-62 (1959). In Czech.

Investigates the current-carrying capacity of large busbars as function of temperature rise. Considers the role of radiation, convection, skin and proximity effects. Shows methods of calculation of the current-carrying capacity with the help of six examples. Graphs and nomograms simplify the calculations. N.Klein

SWITCHGEAR

621.316.5

109 PROBLEMS OF ARC DYNAMICS: RAPID CURRENT AND LENGTH VARIATIONS OF ARCS.

W.Rieder and P.Sokob.

Scientia Electrica, Vol. 5, No. 3, 93-112 (Sept., 1959). In German.

Deals with calculation of voltage and current as functions of time in a circuit in which an arc is rapidly extended. The empirical current—voltage equation for free-burning stationary d.c. arcs can only be extended to arcs carrying rapidly varying current with the aid of a dynamic theory of the arc. Two known dynamic theories are described. The influence of rapid extension of the arc column is dealt with and combined with the dynamic theory by O.Mayr. Using an equation obtained in this way, the above problem can be calculated; the results are proved experimentally. Limitation of the calculation of ohmic circuits is due only to mathematical difficulties.

621.316.543.2

110 ADVANCEMENTS IN PRECISION-MOLDED COMMUTATOR PLATE DESIGN FOR MULTIPLEXING SWITCHES.

A.S.Backus and G.J.Lynch.

I.R.E. WESCON Convention Record, Vol. 3, Pt 6, 100-6 (1959).

The commutator plate described is made by precision moulding the metal inserts therein with an insulating ceramoplastic material having very good thermal and dimensional properties. These superior properties of the material, it is contended, enable contacts to be permanently and accurately positioned in the plate and also enable the contacts to be further processed while secured in the plate to improve their durability for extreme operating applications. In addition, the 3 in. diameter plate can be incorporated into very small multiplexing switches, thus conforming to recent requirements for telemetering systems. The design considerations involved are

described, followed by a synopsis of various tests to which the improved type commutation switches have been subjected.
H.A.Miller

621.316.545 : 621.316.727

111 CONTROL SWITCHES CAPACITORS RELIABLY. J.D.Huddleston.
Elect. Wld, Vol. 152, No. 7, 60-1 (Aug. 17, 1959).
A capacitor control system for up to 4800 kVAr has plug-in thermal delay relays to provide sequential switching of the 600 kVAr blocks. Motor-operated oil switches are placed in the neutral lead of each block. P.Linton

621.316.57

112 AIR OR OIL FOR CIRCUIT-BREAKING. J.A.F.Harvey.
Elect. Times, Vol. 136, 303-5, (Oct. 1, 1959).
Outlines spheres of use of circuit-breakers up to 11 kV in sub-stations and industry with brief notes on the characteristics and mechanism of interruption of oil circuit-breakers and air-break circuit-breakers (as distinct from air-blast). The advantages and disadvantages of each type are briefly reviewed. A.P.Paton

621.316.57 : 621.316.923

113 DISCRIMINATION BETWEEN H.R.C. FUSES AND MINIATURE CIRCUIT-BREAKERS. H.D.Einhorn.
Proc. Instn Elect. Engrs, Monogr. 345U, publ. Oct., 1959, 7 pp. To be republished in Part C.
After a review of the aims and merits of protective devices for low-voltage installations, the joint use of h.r.c. fuses and miniature circuit-breakers is shown to be functional in many installations. The hypothesis that the 0.01 sec fusing current forms a criterion for discrimination is subjected to experimental tests and the statistical nature of discrimination is analysed. Practical conclusions for installation design are drawn, and a new fuse series and various other methods for backing-up miniature circuit-breakers are suggested.

621.316.578

114 EARTH-LEAKAGE CIRCUIT-BREAKERS. J.A.Robbins.
Elect. Rev., Vol. 165, No. 16, 739-44 (Nov. 27, 1959).
A much higher degree of protection can be obtained with earth-leakage circuit-breakers than with fuses provided the device has been installed correctly. Examples of installation conditions which render the e.l.c.b. inoperative are given and remedies and testing procedures are discussed. The operation and reliability of the circuit-breaker itself are also described.

REGULATION

621.316.71

115 CONDITIONS OF APPLICATION OF OPTIMAL AUTOMATIC REGULATORS. O.G.Varshavskii.
Elektrichestvo, 1959, No. 5, 57-9 (May). In Russian.
The case is put for improving the speed of response of regulators by inclusion of non-linear circuits. A general comparison between linear and non-linear controllers is carried out using a phase-plane for determination of performance of a second-order system. T.Horrocks

621.316.71 : 621.375.3

116 AUTOMATIC REGULATORS WITH SELF-BALANCING MAGNETIC AMPLIFIERS. W.A.Geyger.
Trans. Amer. Inst. Elect. Engrs I, Vol. 78, 433-8 (1959) = Commun. and Electronics, No. 44 (Sept., 1959).
The application of the self-balancing magnetic-amplifier technique in the realm of automatic regulators is discussed. It describes two typical examples of such arrangements: (1) a constant-voltage regulator with smoothed low-impedance d.c. output to be used for charging of special types of storage batteries, and (2) a constant-light-intensity regulator with a barrier-layer-type photoelectric cell for instrumentation. Both regulators employ self-balancing magnetic amplifiers with infinite internal gain and have excellent performance characteristics with regard to the respective control problems. Some considerations on the associated constant-voltage and constant current reference circuits are included.

621.316.717 : 621.313.333

117 CALCULATION OF STARTING RESISTANCES FOR AN INDUCTION MOTOR WHEN THE LENGTH OF THE STARTING PERIOD IS SPECIFIED. G.I.Rakhleev.
Elektrichestvo, 1959, No. 7, 25-7 (July). In Russian.
Formulae are evolved enabling starting resistance values to be determined from the mechanical and electrical data of the motor and plant driven by it, when the required duration of accelerating period is specified. A numerical example is given. A.Karlsbad

621.316.718 : 621.375.3

118 MAGNETIC AMPLIFIER CONTROL FOR REVERSING HOT MILL AUXILIARIES. R.L.Duke and L.R.Hulls.
Engng J., Vol. 42, No. 7, 89-92 (July, 1959).
Discusses in general terms the various performance requirements for the drive and control of auxiliary equipment associated with a reversing hot mill, and shows how magnetic amplifier regulators may be used to advantage to produce the systems with the required high standard of performance.

621.316.718.5

119 ELECTRONIC CONTROL REGULATORS. M.J.Collinet.
Bull. Soc. Franc. Elect., Vol. 9, 399-408 (July, 1959). In French.
The basic speed equation is developed for a d.c. motor, (still essential wherever large and graduated speed variation is required) and its behaviour studied for varying armature applied voltages and field currents. The use is described of a thyratron rectifier to produce the required variable d.c. voltage from the normal a.c. mains, to control the speed variation of a d.c. motor. The fundamental principles of operation of a servomotor control circuit are reviewed, and the particular case of speed control is studied in detail. The principle thyratron circuits for speed control are discussed, and reference made to braking, reversal of direction of rotation and maximum-current limiting. Alternative means of feeding a d.c. motor are described briefly, including mercury-arc rectifiers, ignitrons, magnetic amplifiers, and electronically controlled Ward Leonard systems. Several applications of these speed control circuits are outlined. E.F.Hansford

621.316.718 : 621.313.333

THE LOGMOTOR — A CYLINDRICAL BRUSHLESS VARIABLE-SPEED INDUCTION MOTOR. See Abstr. 54

621.316.718.5 : 621.313.2-9

120 D.C. MOTORS WITH A WIDE RANGE OF SPEED REGULATION. Ya.S.Gurin and O.P.Sidorov.
Elektrichestvo, 1959, No. 7, 27-32 (July). In Russian.
A review is made of methods of obtaining a large range of regulation without impairing stability and commutation caused by the high degree of field weakening; they include fitting of an appropriate series winding, slotting of pole pieces, reduction of inertia and, for higher ratios of speed increase, use of split-field windings. Reduction of speed by reducing armature current is also discussed. Data relative to a certain series of existing motors with ratings ranging from 0.5 to 125 h.p. are tabulated. A.Karlsbad

621.316.721

121 THE STABILIZATION OF A STEADY CURRENT OR A MAGNETIC FIELD BY PARAMAGNETIC RESONANCE. R.Reiman.
C.R. Acad. Sci. (Paris), Vol. 249, No. 4, 517-19 (July 27, 1959). In French.
The experimental arrangement of the stabilizer is described and figures for its performance in a typical case are given. The current is stabilized on the paramagnetic resonance signal of DPPH, or alternatively an electromagnet is stabilized with the same apparatus on the proton nuclear resonance signal in water. J.M.Baker

621.316.722.1

122 COMPENSATION OF THE TEMPERATURE DEPENDENCE OF THE REFERENCE VOLTAGE IN TRANSISTOR STABILIZED POWER SUPPLIES. E.Cassignol, P.Chausson, G.Giralt and J.C.Polisset.
C.R. Acad. Sci. (Paris), Vol. 249, No. 5, 659-61 (Aug. 3, 1959). In French.
Summarizes some data on the temperature-coefficient of Zener diodes, of primary cells and of the base–emitter voltage of transistors, and proposes to make use of the generally opposite signs to obtain compensation. F.F.Roberts

621.316.722.1

123 AUTOMATIC SYSTEM CHECKS AUTOMOTIVE VOLTAGE REGULATORS. O.A.Dahms, Jr and C.H.Bobich.
Control Engng, Vol. 10, No. 10, 116-19 (Oct., 1959).

Describes a plug-board-programmed automatic sequencing tester for voltage regulators. A.O.Stanesby

621.316.722.1

124 A SMALL, HIGH VOLTAGE, REGULATED POWER SUPPLY WITH VARIABLE OUTPUT. J.D.O'Toole.
Electronic Engng, Vol. 31, 681-3 (Nov., 1959).

621.316.722.1

125 A TRANSISTORIZED L.T. REGULATOR. J.H.Deichen.
Electronic Engng, Vol. 31, 688-9 (Nov., 1959).

The methods of providing a stabilized d.c. supply for valve heaters are examined and their limitations are discussed. A simple circuit using a transistor and two Zener diodes is then given and its design and performance described.

621.316.722.1

126 DESIGNING HIGHLY STABLE TRANSISTOR POWER SUPPLIES. E.Baldinger and W.Czaja.
Electronics, Vol. 32, No. 39, 70-3 (Sept. 25, 1959).

A summary of design techniques used in making extremely stable low-voltage power supplies for transistor circuits. The final circuit described has an overall stability of ±250 μV and overall drift of less than 40 μV/hr.

621.316.722.1

127 AUTOMATIC A.C. STABILIZER USING AN ELECTROSTATIC COMPARATOR.
L.F.Kulikovski and A.M.Melik-Shakhnazarov.
Priborostroenie, 1959, No. 5, 5-6 (May). In Russian. English translation in: Instrum. Constr., 1959, No. 5, 5-6 (May).

Two forms of the stabilizer, which is a constant current device, are described. In the first, the comparator is similar in construction to a suspended, reflecting, quadrant electrometer, but with two stator sections only. The reference voltage (2.5 to 20 V, normally a battery of standard cells) is connected between one stator plate and earth. The other stator plate is connected to earth through a fixed resistor which carries the controlled a.c. The comparator rotor is earthed. The resistor is in series with another fixed resistor and a servomotor-actuated variable resistor, and the combination is connected across the a.c. supply mains. The servomotor is connected in the output circuit of a photoelectric amplifier. If the comparator is out of balance, the light-beam from its mirror illuminates the photocell, and the servomotor operates to reduce the unbalance to zero. It is not made clear how reversal of the servomotor is effected. No performance figures are given for this stabilizer. In the second type, the comparator electrodes are arranged vertically, and a photoresistor replaces the photocell, amplifier, servomotor and variable resistor. Deflection of the lightbeam from the comparator mirror alters the resistance of the photoresistor. With a variation of the a.c. supply voltage from 150 to 250 V, the alteration in the controlled current is ≤ ± 0.1%. There are, however, current fluctuations of ±1% due to noise in the photoresistor; these are independent of the applied a.c. voltage. C.F.Pizzey

621.316.728

128 AN AUTOMATIC SYSTEM FOR CONTROLLING THE ELECTRICAL POWER DELIVERED TO A FURNACE.
V.S.Lerner.
Priborostroenie, 1959, No.5, 1-4 (May). In Russian. English translation in : Instrum. Constr., 1959, No.5, 1-4 (May).

This system refers to the control of power delivered to a furnace used for lead smelting, which is considered as a symmetrical three-phase system. The phase conductivity for each phase is measured by taking the ratio of the appropriate current and voltage. The power delivered is controlled by displacing the electrodes in the bath. Theory, static and dynamic characteristics, and automatic operation of the system are discussed. T.Horrocks

PROTECTION

621.316.925

129 PILOT-WIRE RELAY CHARACTERISTICS. K.T.Yeates.
Elect. Rev., Vol. 165, No. 13, 594-6 (Nov. 6, 1959).

The operation of the single-phase system consisting of relays and pilot wires is considered on its own and then combined with summation transformers in a three-phase circuit to obtain a comprehensive polar diagram. Theoretical and practical methods of construction of the diagrams are described.

621.316.91 : 621.382.2 : 621.314.63

THE CHARACTERISTICS AND PROTECTION OF SEMICONDUCTOR RECTIFIERS. See Abstr. 76

621.316.91 : 621.313.322-81

FIELD SUPPRESSION OF TURBO-ALTERNATORS. See Abstr. 46

621.316.925

130 BALANCED-CURRENT PROTECTIVE SYSTEMS. J.Rushton.
Elect. Times, Vol. 136, 137-43 (Sept. 3, 1959).

After a brief introduction to the theory of transient stability and equations for the application of biased and unbiased relays, some well-known protective scheme arrangements are examined. These include generator and transformer differential schemes; transformer restricted earth fault, bus-bar and phase fault protection. Factors governing correct design are indicated and application of a summation current transformer connection is described. G.V.Hargreaves

621.316.925 : 621.318.563

OPEN-PHASE PROTECTION FOR HIGH AND LOW-VOLTAGE IN LOW-VOLTAGE MOTORS. See Abstr. 211

621.316.925.4

131 STAGED FAULT TESTS WITH POWER-LINE CARRIER TRANSFERRED-TRIP RELAYING FOR LINE PROTECTION. D.E.Jones.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 588-95 (1959) = Pwr Apparatus Syst., No. 43 (Aug., 1959).

Discusses tests carried out on a 230 kV circuit in order to assess the reliability of power-line carrier equipment for transferred-trip relaying protection of transmission lines. Arcing faults were applied to a line close to the carrier receiving terminal. It was found that carrier equipment provides reliable tripping under these conditions at practical carrier power levels.

621.316.933

132 REQUIREMENTS FOR ARRESTERS FOR PROTECTION AGAINST INTERNAL OVERVOLTAGES.
M. L. Levinshtein and K. P. Kadomskaya.
Elektrichestvo, 1959, No. 8, 9-14 (Aug.). In Russian.

The changeover from 400 to 500 kV in the Votkinsk–Sverdlovsk transmission system and the fall in the insulation level has necessitated special measures being taken for protection against internal surges, one of which is the adoption of a special arrester. The essential requirements of such an arrester, brought to light by a study of internal voltage surges in the system mentioned, are surveyed. Central Electricity Generating Board Digest

621.316.933

133 OVERVOLTAGE PROTECTIVE DEVICES FOR SMALL MEDIUM-VOLTAGE INSTALLATIONS. H.Bitter.
Elektrizitätswirtschaft, Vol. 58, No. 10, 368-72 (May 20, 1959).
In German.

The protective characteristics of a modern American expulsion-type arrester with improved interrupting characteristics are discussed with particular reference to the distance factor between protective device and transformer and the inter-coil stresses to which a transformer winding is liable to be subjected under different conditions of operation. Comparable data are given for the conventional surge diverter. Distance factors are given for system voltages from 3 to 20 kV for a diverter of 2.5 kA rating. R.H.Golde

621.316.933.6

134 OPERATIONAL CERTAINTY, STABILITY AND RELIABILITY OF VALVE-TYPE LIGHTNING ARRESTERS.
M.Doležal.
Energetika (Prague), Vol.9, No.8, 416-18 (1959). In Czech.

Observations show that the main cause of explosions in lightning arresters is the penetration of moisture. This can occur through joints between porcelain and metallic fittings, or through fine cracks in the porcelain itself. Replacement of porcelain by suitable plastic materials is advocated. Arresters were filled with argon, wet and dry nitrogen, and wet and dry air. The highest and most stable voltage at which arresters fired was obtained with dry air. N.Klein

621.316.94 : 621.314.222

135 FERRORESONANCE OF GROUNDED POTENTIAL TRANSFORMERS ON UNGROUNDED POWER SYSTEMS. R.F.Karlicek and E.R.Taylor, Jr.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 607-18 (1959) = Pwr Apparatus Syst., No. 43 (Aug., 1959).

Unearthed 3-ph. 3-wire power systems, which are provided with voltage transformers with their primaries star-connected and earthed for earth fault detection, may oscillate, following a voltage disturbance, as the result of resonance of voltage transformer inductance with the distributed capacitance to earth of the system. The oscillation will persist if energy losses are not sufficiently high, and may damage the v.t's. and endanger other equipment connected to the circuit. Energy losses can be increased by connecting resistors across the delta-connected v.t. secondaries, or by opening and inserting resistance in the delta. Details are given of an analogue computer study of the problem of damping out resonance. A comparison is made with the results of laboratory tests using two types of commercial v.t. C.F.Pizzey

621.316.969

136 TURBO-ALTERNATOR PROTECTION. I. SUPERVISORY INSTRUMENTATION AND PROTECTION AGAINST OVERSPEED FOR LARGE STEAM TURBINES. H.A.Kirby and D.R.Fenwick.
Elect. Rev., Vol. 165, No. 1, 9-15 (Aug. 14, 1959).

On machines operating at advanced steam conditions special instrumentation is necessary to indicate, and where required, to record: (a) shaft eccentricity; (b) differences in expansion between rotating and stationary parts; (c) overall expansion of the turbine; (d) vibration in the bearing pedestals. The governing system of a turbo-alternator must incorporate safety devices to prevent dangerous overspeeding. Special instrumentation and safety devices required are discussed and complications arising due to reheat systems are considered. G.V.Hargreaves

621.316.98

137 THE SHIELDING OF OVERHEAD LINES AGAINST LIGHTNING. J.H.Gridley.
Proc. Instn Elect. Engrs, Paper 3172S, publ. Jan.,1960, 7 pp. To be republished in Vol. 107A (1960).

Most overhead transmission lines carry over-running earth wires, one function of which is to shield phase conductors from direct lightning strokes. Published theories of shielding are incompatible with modern knowledge of lightning. The paper emphasizes the importance of the charges bound on the earth wire and phase conductor by the leader stroke. Equality of charges is taken as a condition under which both wires are equally likely to be struck. For adequate shielding, the charge on the earth wire should exceed that on the conductor. The charges are calculated from the field due to the leader, and it is shown that equality of charges corresponds to both wires lying on the same equipotential of the leader. The limiting position for protection is determined by the slope of the equipotential, and as this depends on the distance between leader and transmission line, the limiting value of which depends on the stroke current, the protection afforded is a function of stroke current. Calculation suggests that shielding is normally adequate for conductors in a wedge of semi-vertical angle 45° of which the apex line is the earth wire.

621.316.992 : 621.315.1

138 LIMITATION OF FAULT CURRENT ON AN EARTH FAULT IN A POWER SYSTEM WITH EARTHED NEUTRAL. MEASUREMENTS ON THE FLESAKER-SÅNER TRANSMISSION LINE [NORWAY]. H.Seljeseth.
Elektrotek. T., Vol. 72, No. 27, 381-6 (Sept. 25, 1959).
In Norwegian.

Measurement and calculation show that two high-conductivity (steel–Al) earth wires will effectively reduce earth fault currents and earth potentials at the base of towers on a transmission line with solid earthing, when an earth fault occurs. Measurements were carried out on the completed 24 km of the line over mountainous terrain. The phase lines consisted of three Fe–Al (37 mm dia.) conductors and the earth lines of two (17 mm dia.) Fe–Al conductors. G.N.J.Beck

TRACTION . DRIVES

621.331.3 : 621.335.2

139 SINGLE-PHASE ALTERNATING CURRENT ELECTRIC TRACTION AT INDUSTRIAL FREQUENCY [50 OR 60 c/s] AND PLANT FOR RECTIFIER-MOTORS. M.Y.Machefert-Tassin.
Rev. S-W, No. 27, 3-97 (Dec., 1958). In French.

A historical survey of rectifier-locomotives is given, followed by detailed descriptions of various designs developed in different countries. A table is given comparing 1.5 kV d.c. and 25 kV 50 c/s single-phase a.c. locomotives.

621.332

140 RELATIONSHIP BETWEEN THE CONVENTIONAL RUNNING EXPENSES OF THE ELECTRIFIED RAILWAYS AND THE PARAMETERS OF THE ELECTRICAL EQUIPMENT. L.G.Abelishvili.
Elektrichestvo, 1959, No.6, 28-30 (June). In Russian.

The main costs, depending upon the selection of the cross-section of the contact wire and the distance between substations, are : (1) amortization of the capital cost; (2) losses in the contact line; (3) effect of voltage fluctuations upon the speed of trains; and (4) substations operational costs. The optimal values of the above parameters are calculated and it is found that the deviation from them has little effect when the cross-section is varied, whilst the correct selection of the distance between substations may bring considerable saving. Graphs showing the relationship are produced A.Karlsbad

621.332.3

141 THE OVERHEAD-LINE EQUIPMENT OF THE 1-PHASE 25 kV 50 c/s LINES OF THE COMPANHIA DOS CAMINHOS DE FERRO PORTUGUESES. R.Tritter and C.Lorenz.
Glasers Ann., Vol. 83, No. 5, 147-52 (May, 1959). In German.

Three interconnected lines of the Portuguese State Railways with a total length of 87 miles have been adapted to electrical traction with 25 kV a.c. at the standard frequency. Total length of track is about 220 miles, and there is a tunnel 1.6 miles long. The construction of the overhead equipment which is partly designed for a speed of 81 miles/hr and partly for 62 miles/hr is described in some detail. V.Quittner

621.335.2

142 CONSIDERATION OF THE RESONANCE PHENOMENA IN THE TROLLEY SYSTEM IN THE OPERATION OF RECTIFIER LOCOMOTIVES. V.N.Livshits and N.K.Matveeva.
Elektrichestvo, 1959, No. 8, 41-5 (Aug.). In Russian.

Investigates distribution of the non-sinusoidal load current of the locomotive in the trolley system and analyses the spectrum of the harmonics. The usefulness of formulae suggested and used by previous authors is critically analysed, as also are the results of some recent experimental investigations in Soviet single-phase traction systems. Electrical Research Association

621.337.66

143 GEOGRAPHICAL CIRCUIT TECHNIQUE. H.A.Codd.
Proc Instn Rly Signal Engrs (1958) 134-65.

A detailed treatment of track control and layout system for railways is given with particular reference to continental systems. The system is based on multi-contact plug-in relays and incorporates automatic route selection on a two push-button basis complete with pictorial presentation. R.W.J.Cockram

621.34 : 621.313.13

144 A MOTOR DRIVE FOR THE FEED OF HEAVY MACHINE TOOLS. V.A.Naidis.
Elektrichestvo, 1959, No. 10, 27-33 (Oct.).

A description is given of a drive system with d.c. motors supplied from a rotary amplifier. The system provides for a high amplification factor, speed stability, good transient response conditions, and good stability within a wide range of speed control. The small number of feed-backs, absence of switching processes during regulation, and the small quantity of variable elements mean that the system is simple to adjust and stable in operation. Metropolitan-Vickers

621.34

145 THE MOTOR DRIVE FOR THE SCREW ON THE ATOMIC ICE-BREAKER "LENIN".
V.L.Bershadskii, V.K.Kalashnikov, V.V.Kryazheskii and G.A.Popov.
Elektrichestvo, 1959, No. 10, 50-6 (Oct.). In Russian.

Describes the electric drive system used for coupling the steam turbines to the propellor, with particular reference to the main circuits and the control system.

621.34

146 MODELLING THE MOTOR DRIVE FOR THE SCREW ON THE ATOMIC ICE-BREAKER "LENIN".

L.V.Maziya and F.Sh.Sakaev.
Elektrichestvo, 1959, No. 10, 56-62 (Oct.). In Russian.

CONDUCTORS . RESISTORS

(See also Semiconductor Materials)

621.315.57 : 621.316.825.2

147 THERMISTORS, THEIR THEORY, MANUFACTURE AND APPLICATION. R.W.A.Scarr and R.A.Setterington.
Proc. Instn Elect. Engrs, Paper 3176M, publ. Jan., 1960, 11 pp. To be republished in Vol. 107 B (1960).

Thermistors are components of comparatively recent development, although the phenomenon of conduction in metallic salts was recorded by Faraday over a century ago. In a broad survey of the subject, the theory of their operation is described, and it is explained why they, in common with other semiconductor devices, possess a negative temperature coefficient of resistance. The expressions which govern their parameters are developed. Methods of manufacture of the various forms of thermistor are outlined in general terms, and numerous applications of the device are described and discussed. Guidance is given on the approach to circuit problems, and the possibilities of exploiting some of the device's interesting and unusual properties are indicated. The point is made that the thermistor can now be used in many fields as an adequate alternative to components of more specialized application.

INSULATING MATERIALS
DIELECTRICS

621.315.61 : 621.372

148 ON RAISING THE FREQUENCY BANDWIDTH OF THIN "λ/4-LAYER" ABSORBERS FOR ELECTROMAGNETIC CENTIMETRE WAVES. R.Pottel.
Z.angew. Phys., Vol.11, No.2, 46-51 (Feb., 1959). In German.

The layers are materials, with metal backing and a dielectric constant and permeability which may suitably vary with frequency. The wavelength is that in the material, thus the layers are thin compared with the free space wavelength λ, in fact thinner than 1/30λ. Layers used so far have very small effective bandwidth. The question, examined theoretically, is whether materials with suitable frequency dependence on ϵ and μ can exist which could give improved performance as reflexion-free coatings. This is done by means of the Kramers-Kronig relations. The necessary conditions for the slopes of the curves of the real and imaginary parts of ϵ and μ are deduced and it is shown that these cannot be realised for any material where electric and magnetic polarization depend linearly on field strengths. H.Motz

621.315.612

149 NEW CERAMOPLASTIC INSULATING MATERIALS FOR 500°C. ELECTRONIC COMPONENT APPLICATIONS.

A.S.Backus and P.S.Hessinger.
I.R.E.WESCON Convention Record, Vol.3, Pt 6, 107-12 (1959).

Two materials of the "Mycalex" type are described. They are made by mixing synthetic fluor-phlogopite mica with glass and ceramic binders. One is a machinable material which is heat resistant up to 850°C, the other a mouldable material for use up to 500°C. The expansion coefficient matches stainless steel, so that metal inserts can be incorporated in the manufacturing process. The essential dielectric properties are given and a number of applications are enumerated. K.W.Plessner

621.315.614.64

150 THE LAWS OF THE DETERIORATION OF OIL-IMPREGNATED PAPER IN TRANSFORMERS.

J.Fabre.
Bull. Soc. Franc. Elect., Vol. 9, 399-408 (July, 1959). In French.

This study applies mainly to kraft paper but most of the results are also applicable to manilla paper. The state of deterioration of paper is described by: the polymerization index (determined by measuring the viscosity of a solution of paper, in a suitable solvent under stated conditions); the copper index (determined from the reaction between the cellulose and Fehling's solution); and by the neutralization value (organic acids). The polymerization index is the most important of these criteria and is closely related to the mechanical properties of the paper. Appreciable quantities of water are formed only when the deterioration of cellulose is advanced. The influence of temperature, humidity and oxygen on the properties of oil-impregnated paper were studied by following the polymerization index, which displays much less scatter than do mechanical tests. Thermal deterioration of paper is proportional to the water content and this factor is so important that a special study was made of the humidity equilibrium between air–oil–paper. The water content of paper taken from transformers in service ranged from 1.6 to 4.7% and that of paper samples kept immersed in transformers in service from 1.9 to 7.2%. It is suggested that after long periods of service oil-immersed paper in transformers acquires a water content equal to the equilibrium figure for paper in contact with the local atmosphere. The use of adsorbents to remove water from oil in service is described. W.R.Stoker

621.315.614 : 621.315.21 : 621.317.333

THE IMPULSE STRENGTH OF IMPREGNATED-PAPER DIELECTRICS AS USED IN HIGH-VOLTAGE CABLES. See Abstr.157

621.315.61

151 THE LIFE OF INSULATION IN ELECTRICAL MACHINES AS AFFECTED BY THERMAL AGING. M.I.Mantrov.
Elektrichestvo, 1959, No. 6, 68-71 (June). In Russian.

The relation between ageing time, t, and absolute temperature, T, is given for an insulating material by $\ln t = (B/T) + A$, where A and B are constants depending on the material. The activation energy Q is given by $Q = BR$, where R is the universal gas constant. Values of A, B, and Q are tabulated for a range of insulants.

E.M.Dembinski

621.315.61

152 MATHEMATICS OF INSULATION-AGING CALCULATIONS. L.C.Whitman and W.W.Whitman.
Trans Amer. Inst. Elect. Engrs I, Vol. 78, 308-18 (1959) = Commun. and Electronics, No. 44 (Sept., 1959).

Equations are developed for the calculation of insulation ageing in apparatus, in which it is recognized that the temperature of the apparatus usually changes in accordance with an exponential relation. The results from this method are compared with the simplification usually made of assuming rectangular temperature cycles and also with the assumption of a triangular temperature cycle. Insulation ageing rate is based on the use of the Arrhenius chemical reaction rate theory, which relates insulation deterioration to the reciprocal of the absolute temperature. All ageing values are in terms of relative ageing, which assigns a value of unit ageing to a specified temperature. To establish the errors involved in the simplifying assumptions conventionally used in ageing computations, the calculations are carried out to more significant figures than basic ageing data and time constants would justify.

621.315.612.4

153 FLAME-SPRAYED CERAMIC DIELECTRIC FOR TRANSDUCERS. G.V.Planer and A.Foster.
J. Brit. Instn Radio Engrs, Vol. 19, No. 11, 699-702 (Nov., 1959).

A high speed electro-mechanical transducer system based on the Johnsen–Rahbek effect is described, in which a flame-sprayed ceramic of high permittivity replaces the conventional semiconductor. Among advantages of the system are its operation at high pulse-repetition frequencies, relatively large mechanical thrusts obtainable at low signal voltages, good wear characteristics, as well as ease and economy of producing large ceramic rotors.

621.315.61 : 621.315.2

GASEOUS DISCHARGE PHENOMENA IN HIGH-VOLTAGE D.C. CABLE DIELECTRICS. See Abstr. 91

621.315.615.2

154 INVESTIGATIONS ON THE AGEING OF TRANSFORMER OILS IN DEPENDENCE UPON THEIR CONSTITUTION.

R.Müller and T.Wörner.
Elektrotech. Z. (E.T.Z.) A, Vol. 80, No. 18, 623-8 (Sept. 11, 1959). In German.

Transformer oils of different origin and from various refining processes were artificially aged at 110° C. A copper wire served as catalyst. The aromatic content of the oils was assessed by their absorption at 6.2 μ and their neutralization number, sludge content, and dielectric loss factor was measured. Whilst during ageing the neutralization number and sludge content followed a similar trend (with but one exception), the order of merit of the oils was different with regard to the change in the loss factor. It is concluded that the aromatic content of an insulating oil by itself is not a measure of its ageing behaviour, that some aromatic constituents are natural oxidation inhibitors and liable to hydrogeneration in a corona discharge, whereas others promote ageing. The increase in the loss factor during ageing is ascribed to the formation of associated oxidation products as well as to compounds containing a CO-group. R.Schnurmann

MEASURING METHODS
ELECTRICAL TESTING

621.317.32

155 MEASUREMENT OF THE ELECTRIFICATION OF INSULATING SHEETS. Z.Croitoru.

Rev. gen. Elect., Vol. 68, No. 8, 489-96 (Aug., 1959). In French.

Using elementary electrostatic theory, two quantities, a mean charge and a mean polarization, are defined and it is then shown how they can be measured by an induction method and used to describe the electrification of an insulating sheet. An apparatus consisting essentially of a probe and a current-integrating device is briefly described and its application is illustrated by descriptions of two examinations of charged sheets. One sheet had been charged by rubbing and the other by the application of an electric field. The surface area of the probe can be varied between 3 mm^2 and 50 cm^2. A.E.Kay

621.317.331

156 RESISTIVITY PROSPECTING. J.H.Morgan.

Instrum. Pract., Vol. 13, No. 10, 1031-4 (Oct., 1959).

Resistivity measurements by the 4-electrode method are quoted, with variations including a 2-layer test method and one for outcropping strata. A particular prospect of the River Taw area in Dartmoor is given, locating suitable sites for water-boring which were found to be accurate within 10%. An operating technique is given based on minimum expenditure. E.H.W.Banner

621.317.333 : 621.315.614 : 621.315.21

157 THE IMPULSE STRENGTH OF IMPRE NATED-PAPER DIELECTRICS AS USED IN HIGH-VOLTAGE CABLES. B.Salvage and J.A.M.Gibbons.

Proc. Instn Elect. Engrs, Paper 3143S, publ. Dec., 1959, 10 pp. To be republished in Vol. 107A (1960).

An investigation into the impulse strength of model cables and cable-impregnating oils and compounds is described. In particular, the effects of the density, air impermeability and thickness of the paper and the dielectric thickness and temperature of the impregnant have been studied. Special papers possessing a combination of properties designed to give a high impulse strength have been incorporated in an experimental oil-filled cable and the improvements obtained closely approach those indicated by measurements on model cables. An impulse breakdown mechanism in a fully-impregnated-paper cable dielectric is suggested whereby the impulse strength, although it may be varied by changing the properties of the paper, is shown to be primarily dependent on the impulse strength of the impregnant.

621.317.333

158 EXPERIENCE IN RECENT MAINTENANCE TESTS ON GENERATOR WINDINGS OF THE ENNS HYDRO-ELECTRIC POWER STATION. F.Pepelnik.

Österr. Z. ElektWirtsch. (Ö.Z.E.), Vol. 12, No. 10, 531-6 (Oct., 1959). In German.

A description of periodic tests carried out to determine the condition of the winding insulation in order to forestall a breakdown. Tests with high-voltage a.c. give readings of the loss-angle and capacitance. Tests with high-voltage d.c. give the variation of charging and discharging currents with time and the insulation resistance. Comparative tests over several years are shown. In all, there are 13 generators in the system, varying from 7.5 to 32 MVA per unit with a rated voltage of 6.3 kV. R.G.Jakeman

621.317.333.4

159 FACTORY TESTING OF ELECTRICAL PROTECTIVE RUBBER GLOVES. G.Irresberger.

Bull. Assoc. Suisse Elect., Vol. 50, No. 16, 800-3 (Aug. 1, 1959). In German.

A test is described in which the gloves are placed in a water bath and an alternating voltage of 6 kV is applied between the inside of the gloves, also filled with water, and the bath. A dry test for leather gloves is mentioned, and American and British specifications are referred to. K.W.Plessner

621.317.335

160 A CLOSE LOOK AT CONNECTION ERRORS IN CAPACITANCE MEASUREMENTS.

Gen. Radio Exper., Vol. 33, No. 7, 3-12 (July, 1959).

621.317.337

161 A METHOD FOR THE MEASUREMENT OF VERY HIGH Q-FACTORS OF ELECTROMAGNETIC RESONATORS. F.H.James.

Proc. Instn Elect. Engrs, Paper 2847 R, publ. Jan., 1959 (Vol. 106B, 489-91, 492-4).

Republication, with discussion, of the paper abstracted in Abstr. 1442 (1959).

621.317.34

162 HIGH FREQUENCY MEASURING TECHNIQUES. [Hochfrequenz-Messtechnik]. O.Zinke and H.Brunswig.

Stuttgart: S.Hirzel (1959), xiv + 234 pp., [Monographien der elektrischen Nachrichtentechnik Vol. 3a]. In German.

Methods of measurement, apparatus and standards covering the range from audio-frequencies to the microwave region are described. Treatment is brief, but there is a bibliography at the end of each chapter. There are 258 diagrams. Chapter headings are: (1) Signal generators; (2) Measurement of current; (3) Measurement of voltage; (4) Measurement of power; (5) Measurement of impedance, especially of resistors, capacitors and coils; (6) Measurement of phase angle; (7) Measurements on quadripoles, especially lines and cables; (8) Measurements on aerials; (9) Measurement of frequency, frequency monitoring; (10) Determination of wave-shape or frequency spectrum: Oscillographs; (11) Measurement of modulation; (12) Measurements on receivers. C.F.Pizzey

621.317.34

163 HIGH FREQUENCY MEASURING APPARATUS. [Hochfrequenz-Messgerate]. O.Zinke and H.Brunswig.

Stuttgart: S.Hirzel (1959), viii + 50 pp. [Monographien der elektrischen Nachrichtentechnik Vol. 3b]. In German.

Details are given in tabular form of the products of 33 manufacturers in various countries (19 are German). In addition to a normal index, references are given to the appropriate chapter and section in Vol. 3a (see preceding abstract). C.F.Pizzey

621.317.34 : 621.372.823

164 RESONANT-CAVITY MEASUREMENTS OF CIRCULAR ELECTRIC WAVEGUIDE CHARACTERISTICS. J.A.Young.

Proc. Instn Elect. Engrs, Paper 3004 E [Convention on Long-Distance Transmission by Waveguide] publ. 1959 (Part B Suppl. No. 13, 62-5).

Resonant-cavity techniques provide a powerful method for evaluating circular-electric-mode waveguide performance, particularly attenuation, mode conversion and bend-loss characteristics. The waveguide to be tested forms the side wall of the resonator. Thus, a few samples of special waveguide may be sufficient to check design parameters. Cavity measuring equipment operating at frequencies between 50 and 60 Gc/s has been designed and used to study $\frac{2}{16}$ in, $\frac{1}{2}$ in and 2 in-inner-diameter copper, helix and dielectric-lined waveguide. Q-factors as high as 3.5×10^6 have been measured for a 30 ft long 2 in-diameter copper cavity at room temperature. Attenuation characteristics are obtained by measuring several cavities of different lengths to obtain end-wall and coupling corrections. A pure-mode coupler is used to excite the cavity, allowing mode-conversion effects caused by power transferred from the circular electric to other modes generated by side-wall imperfections to be measured when both modes are resonant simultaneously.

621.317.34 : 621.372.823

165 TESTING OF CIRCULAR WAVEGUIDES USING A RESONANT CAVITY METHOD.

A.E.Karbowiak and R.F.Skedd.

Proc. Instn Elect. Engrs, Paper 2848 R [Convention on Long-Distance Transmission by Waveguide] publ. 1959 (Part B Suppl. No. 13, 66-70).

A description given of equipment and instruments suitable for the determination of the attenuation of circular waveguides of the type appropriate for long-distance transmission. Essentially the procedure consists of measuring the Q-factor of a resonator formed by the length of the waveguide to be tested (a few metres long), short-circuited at both ends, and deducing the attenuation figure therefrom. Some experimental results are quoted to illustrate the versatility of the equipment, its limitations and accuracy.

621.317.34 : 621.372.83

166 THE MEASUREMENT OF SPURIOUS MODES IN OVER-MODED WAVEGUIDES. Y.Klinger.

Proc. Instn Elect. Engrs, Paper 3040 E [Convention on Long-Distance Transmission by Waveguide], publ., 1959 (Part B Suppl. No. 13, 89-93).

A simple method is described for measuring the fraction of power in spurious modes generated by a transducer in the presence of the main mode. This method is applicable when the energy in the spurious mode is small and its guide wavelength is different from that of the main mode. Briefly it involves measuring the input standing-wave ratio as a function of the position of a short-circuiting piston in the multimode waveguide. From the pattern of the absorption resonances so obtained, together with their shape and spacing, the modes can be identified and their energy contents calculated. The attenuation coefficients can be derived from the measurements if desired, but this is not essential for the calculation of the coupling coefficient.

621.317.34

167 COAXIAL-CABLE PERFORMANCE, DETERMINATION OF SINE-SQUARED PULSE RESPONSE. W.A.Cameron.

Electronic Radio Engr, Vol. 36, No. 9, 349-52 (Sept., 1959).

Methods are described for the calculation and measurement of the response of a length of cable to a transient waveform of given shape. In particular, a curve has been derived for the attenuation of the height of an 0.1 μsec $\sin^2$ pulse propagating through 0.375 in diameter coaxial cable of the type used for trunk telephony.

W.A.Cameron

621.317.34 : 621.395.5 : 621.395.74

168 A METHOD OF LOCATING DRY JOINTS IN TELE-COMMUNICATION CABLES. J.Rhodes.

Proc. Instn Elect. Engrs, Paper 3025 E, publ. Sept., 1959 (Vol. 106B, 470-2).

A description is given of a method of locating dry joints in telecommunication cables. The method is based upon the non-linear properties of dry connections and has been used successfully on both land and submarine cables.

621.317.34 : 621.391.821 : 621.396

THE MEASUREMENT OF ATMOSPHERIC RADIO NOISE BY AN AURAL COMPARISON METHOD IN THE RANGE 15-500 kc/s. See Abstr. 443

621.317.34 : 621.372.8

A SERIES OF MEASUREMENTS CARRIED OUT IN WAVEGUIDES FOR LONG-DISTANCE TRANSMISSION. See Abstr. 256

621.317.34 : 621.372.823

SURVEY OF METHODS USED TO IDENTIFY MICROWAVE FIELDS OR WAVE MODES IN CYLINDRICAL WAVEGUIDES. See Abstr. 266

621.317.34 : 621.372.823.2

EQUIPMENT FOR MEASURING THE ATTENUATION OF LOW-LOSS WAVEGUIDE TRANSMISSION LINES. See Abstr. 271

621.317.341 : 621.372.823

ATTENUATION MEASUREMENTS: TE_{01} WAVES IN CIRCULAR WAVEGUIDES IN THE VICINITY OF 25 AND 35 Gc/s. See Abstr. 267

621.317.37

169 AN ALTERNATIVE METHOD FOR COMPARING THE ELECTRICAL PROPERTIES OF EPOXY CASTING RESINS. D.H.Thompson.

Electronic Engng, Vol. 31, 686-7 (Nov., 1959).

Describes a method of assessing the dielectric constant, loss, and volume resistivity of epoxy casting resins over a wide temperature range and for frequencies up to 5 Mc/s. This coverage is achieved at the expense of reduced absolute accuracy when compared with the standard method of Hartshorn and Ward; however, when primarily used for comparison of resins and assessing the temperature stability of their electrical parameters, the method described here merits more widespread use. In particular, absolute values may be quoted from this method provided care is taken to verify or normalize the results at laboratory temperature.

621.317.37

170 A SIMPLE METHOD FOR THE DETECTION AND STUDY OF BREAKDOWN IN THE INTERIOR OF DIELECTRICS AND ITS POSSIBLE APPLICATIONS. V.Mòdoni.

Industr. Ital. elettrotec., Vol. 7, No. 12, 241-51 (July, 1959).

In Italian.

One mechanism for breakdown in solid dielectrics is the ionization-induced breakdown across the cavities which normally exist inside the solid. A novel electrical method for detecting and studying this form of breakdown is described. The onset of breakdown is clearly displayed on a cathode-ray tube. A correlation between humidity content of the dielectric and the breakdown by ionization and a correlation between the humidity content and the critical breakdown strength of the solid are observed. The method may be used as an auxiliary test of the results for solid dielectrics and in particular for testing the insulating properties of capacitors, electrical machines, and gaps. C.A.Hogarth

621.317.39

171 MECHANICAL AND ELECTRICAL METHODS OF WEIGHING WITH PRECISION BALANCES. L.Biétry.

Bull. Assoc. Suisse Elect., Vol. 50, No. 20, 973-6 (Sept. 26, 1959).

In German.

The mechanical balance considered is the beam type with knife-edge bearings. The electrical type compared with it consists of a permanent magnet d.c. moving-coil system with the coil axis horizontal and carrying a horizontal arm with a scale-pan suspended from its outer end. When the system is unbalanced by placing the object to be weighed in the scale-pan, balance is restored by passing a suitable current through the coil. The current is derived from a potentiometer calibrated in weight units and fed by a highly stable d.c. source. An alternative arrangement, which does not require a stable d.c. supply, uses two potentiometers connected to form a bridge, with a galvanometer for detecting bridge unbalance. Curves show that the mechanical balance with knife-edge bearings will weigh up to 20 g with a reproducibility of $\pm 2 \times 10^{-6}$g; the corresponding figure for the electrical balance described is, except for loads < 10 mg, many times greater. C.F.Pizzey

621.317.39

172 MINIATURE PHOTOCELL MEASURES BLOOD VOLUME. H.E.Guttmann.

Electronics, Vol. 32, No. 37, 122 (Sept. 11, 1959).

A plethysmograph consisting of two half rings clipped together on the finger, one carrying a miniature lamp and the other a photocell, is described. The current in the photocell is a measure of the varying volume of blood between these two points. It is stated to be easy to apply and relatively independent of muscle movements.

F.T.Farmer

621.317.39

173 TEMPERATURE MEASUREMENT IN TRANSIENT REGIME IN MACHINES OR ELECTROMECHANICAL DEVICES. R.G.de Olea de la Peña.

An. Mecan. Elect., Vol. 36, No. 4, 171-84 (July-Aug., 1959).

In Spanish.

Heat generation and dissipation in a rectifier are investigated and two methods are discussed for the measurement of temperature in the transient state, e.g. for overload conditions. The first method consists in finding the functional relation between current, time and temperature by combining the experimental relations between current and power dissipated on the one hand and between temperature rise, power dissipated and time on the other hand. Methods of determining these relations are described. The second method is based on the analogy between thermal and electrical processes. The two

methods are critically compared and their respective applications are discussed. The use for metal-vapour rectifiers is given only as an example and the methods described may also be applied with modifications on electromechanical devices in general.

R.Neumann

621.317.39 : 536.51

174 CAPACITOR THERMOMETER FOR HYDROLOGIC INVESTIGATIONS. S.S.Srivastava and V.Padmanabhan.
J. sci. industr. Res., Vol. 18B, No. 8, 345-6 (Aug., 1959).

Description of apparatus for temperature measurement in shallow waters down to 50 ft. A temperature-sensitive capacitor is employed in connection with electronic equipment. An accuracy of ±0.05° C has been obtained under laboratory conditions.

A.J.Ingels

621.317.39 : 621.362

175 A METHOD OF REDUCING THE TIME LAG OF TRANSDUCERS WHICH HAVE AN EXPONENTIAL RESPONSE. L.Whitlow and M.J.Porter.
Electronic Engng, Vol. 31, 536-42 (Sept., 1959).

A method of reducing the time lag of thermocouples, or other transducers which have a simple exponential response, is described. The output voltage from a thermocouple is added to its amplified derivative, this corrects the response for both phase and amplitude. The limiting factor, in reducing the time lag, is the ratio of the input signal to the electrical noise generated in the equipment. Design details and the performance of a drift corrected d.c. amplifier and a highly stable power supply are also given.

621.317.39

176 AN ELECTRONIC TACHOMETER FOR AUTOMOBILES. M.J.Wright.
Electronic Engng, Vol. 31, 599-602 (Oct., 1959).

An electrical signal having a fundamental frequency proportional to engine speed is obtained from the automobile ignition system. A novel circuit, which combines filtering and limiting functions, removes undesired oscillations and feeds a fixed amplitude square wave to a diode pump frequency measuring circuit which is calibrated directly in terms of engine speed. The complete circuit is simple, contains no active components and is powered by the automobile battery. The calibration is little affected by changes in either the battery voltage or ambient temperature.

621.317.39

177 USING ISOTOPES TO MEASURE LOW PRESSURES. G.F.Vanderschmidt.
Electronics, Vol. 32, No. 25, 60-1 (June 19, 1959).

An ionization chamber is provided with a tritium source mounted on an internal wall. A voltage is briefly applied across the chamber and the subsequent rate of fall of voltage is a measure of the density of the air in the chamber. A blocking oscillator is used to measure the rate and produces a pulse rate that is directly related to pressure over a wide temperature range.

T.Mulvey

621.317.39

178 RECORDING PUPIL CHANGES FOR CLINICAL DIAGNOSIS. G.W.King.
Electronics, Vol. 32, No. 39, 67-9 (Sept. 25, 1959).

A rotating drum with slits in its periphery provides a scanning light spot directed on to an area 14 × 7 mm on each eye. The reflected light is picked up by two photocells operating twin recorders as well as giving a display on a c.r. tube. Movements of the two pupils can be measured with an accuracy of 0.1 mm and a time constant well under 1 sec.

F.T.Farmer

621.317.39

179 AUTOMATIC RECORDING OF LUMINOUS INTENSITY DIAGRAMS. W.Bühler.
Philips tech. Rev., Vol. 20, No. 10, 288-90 (1958-59).

Short description of an instrument that automatically records contours of constant luminous intensity (isocandela curves) from a light source; it traces these on a grid, the coordinates of which may be the azimuth and elevation of the direction of measurement. The instrument can trace closed loops, so that it is suitable for measurements on beamed light sources. The recorder portion of the instrument can also be used for the tracing of other kinds of "iso" curves.

621.317.44 : 621.396.823

180 MAGNETIC-FIELD PICKUP FOR LOW-FREQUENCY RADIO-INTERFERENCE MEASURING SETS. M.Epstein and R.B.Schulz.
I.R.E. Nat. Convention Record, Vol. 7, Pt 8, 64-76 (1959).

The Hall effect in indium antimonide is used to measure magnetic fields in the range 10^{-9} G from 30 c/s to 15 kc/s, and ferrite rods are used to concentrate the magnetic flux. Use of the semiconductor leads to a uniform frequency response down to d.c., direct single point calibration, detection of flux density at a point, negligible loading effects on the H-field and the use of a very small detector. Details are given of a special element configuration which effectively places in series a number of Hall-effect voltages for providing a high output signal, together with design theory for ferrite flux-concentrators.

J.MacCormack

621.317.61

181 A SIMPLE TRANSISTOR TESTER. G.G.Yates.
Electronic Engng, Vol. 31, 602-3 (Oct., 1959).

A simple and inexpensive instrument is described for the measurement of the more useful parameters (I_{CO}', β, h_{11}', f_α) of low power a.f. and r.f. transistors. I_{CO}' and β are determined by a d.c. method, no additional apparatus being required. For the determination of h_{11}' and f_α a signal generator with a frequency range from below 1 kc/s to about 200 kc/s and a valve-voltmeter or oscilloscope are required, in addition.

621.317.61 : 621.382.3 : 621.316.5

182 THE MEASUREMENT OF TRANSISTOR TRANSIENT SWITCHING PARAMETERS. J.J.Sparkes.
Proc. Instn Elect. Engrs, Peper 3006 [International Convention on Transistors and Associated Semiconductor Devices], publ. 1960, (Part B Suppl. No. 15, 562-6, 567).

New parameters for use in the design of switching circuits are defined. These parameters relate the charge in the base region of the transistor to the terminal currents at given collector-base voltages. The relation of these parameters to small-signal parameters and rise-and-fall times is summarized, and methods of measurement using either normal small-signal techniques or transient techniques are described and discussed. The transient tests involve driving the transistor in the common-emitter configuration, through a parallel RC coupling circuit, by means of a square-wave generator. Under certain conditions the coupling capacitances and resistances yield values of the switching parameters.

621.317.619 : 621.315.59

183 AN ULTRA-SHORT LIFETIME APPARATUS. C.G.Peattie, W.J.Odom and E.D.Jackson.
Proc.Instn Elect.Engrs, Paper 3015E, [International Convention on Transistors and Associated Semiconductor Devices], publ. 1960 (Part B Suppl. No.15, 303-7).

An apparatus is described for measuring the lifetimes of photo-injected excess carriers and surface-recombination velocities in semi-conductors by the decay of photo-conductivity. The use of a high-intensity carbon arc, front-surface mirrors (one of which can be rotated at speeds up to 25 000 r.p.m.), shaping slits and a relatively long optical lever (18-20ft) produces a light pulse that is essentially rectangular. The apparatus has been used to measure time-constants from 32 microsec to 6.6 millimicrosec. Curves of photo-conductive rise and decay are shown for indium-antimonide detector cells, a multiplier phototube and high-resistivity silicon.

INSTRUMENTS
MEASURING APPARATUS

621.317.7

184 RATIONALIZATION OF CALIBRATION IN QUANTITY PRODUCTION OF ELECTRICAL MEASURING INSTRUMENTS. A.Hug.
Bull. Assoc. Suisse Elect., Vol. 50, No. 16, 797-800 (Aug. 1, 1959). In German.

A review of the problems involved in reducing time and cost of calibration of industrial and precision types of instrument, and of the characteristics required in calibrating apparatus and electrical supplies.

C.F.Pizzey

621.317.71

185 A BALANCED TRANSFORMER FOR PRECISION MEASUREMENT OF HIGH DIRECT CURRENTS. L.Abraham and K.Heumann.
Elektrotech. Z. (E.T.Z.) A, Vol. 80, No. 18, 629-32 (Sept. 11, 1959). In German.

The transformer consists of two high-μ ring cores mounted side by side and surrounding the d.c. conductor or bus-bar. The cores are wound with an equal number of turns, and the coils connected in series to a variable d.c. source. The polarities are such that with current flowing through the central conductor, the flux in the rings can be reduced to zero by suitably adjusting the current through the coils. The coil current is measured by means of a shunt and precision moving-coil instrument, or a standard resistor and d.c. potentiometer. The current in the central conductor is given by (coil current × coil turns). For balance detection, a centre-tapped winding on the rings is fed with 50 c/s current from the centre-tapped secondary of a separate transformer. The balance detector is a c.r.o. or a phase-sensitive rectifier and moving-coil instrument, and is connected between the two centre-taps. Under unbalanced conditions a 100 c/s voltage is produced which vanishes at exact balance. A screening core of silicon–iron eliminates errors due to external fields. In the example given, the current is 20 kA, the coil turns 400 and the coil current 50 A. It is stated that currents up to 100 kA can be measured with an accuracy of 0.1 to 0.01%, and that the apparatus does not require calibration.

C.F.Pizzey

621.317.726

186 A VOLTMETER FOR MEASURING THE PEAK VALUE OF AN INDIVIDUAL HIGH TENSION PULSE.

G.Giralt and E.Krouk.

C.R. Acad. Sci. (Paris), Vol. 249, No. 12, 1042-4 (Sept. 21, 1959). In French.

The principle of operation is described in an earlier paper; see Abstr. 4635 of 1958. The h.t. capacitor is of cylindrical construction, with air dielectric, capacitance 15.23 pF, and is usable up to 50 kV peak. An automatic switch connects the ballistic galvanometer to the capacitor. The switch consists of a thyratron, a relay and a storage capacitor which is charged by a d.c. supply. The grid of the thyratron is negatively biassed, and is connected to an aerial. When an h.t. pulse is applied to the h.t. capacitor, the thyratron grid is driven positive, and the storage capacitor discharges through the thyratron and the relay coil. The operating time is ~ 18 msec. The apparatus will measure h.t. pulses of 0.1 μsec to 10 msec duration. Positive or negative pulses can be measured.

C.F.Pizzey

621.317.729.1

187 THE APPLICATION OF ELECTROLYTIC BATH TO A CALCULATING CIRCUIT. G.P.Prudkovskii.

Pribory i Tekh. Eksper., 1959, No. 3, 77-9 (May-June). In Russian.

An automatic plotter is described for the construction of charts of equipotential harmonic fields simulated in an electrolytic bath. An application of such a bath for the determination of set functional relationships is also considered.

T.Horrrocks

621.317.729.3 : 621.372.82

188 THE SPINNING-DIPOLE TECHNIQUE APPLIED TO THE MEASUREMENT OF WAVEGUIDE MODES.

H.E.M.Barlow and M.G.F.Wilson.

Proc. Instn Elect. Engrs, Paper 2845R [Convention on Long-Distance Transmission by Waveguide], publ. Jan., 1959 (Part B Suppl. No. 13, 84-8, 97-9).

Republication, with discussion, of the paper abstracted in Abstr. 807 (1959).

621.317.733

189 A SHORT NOTE ON THE CONDITIONS FOR MAXIMUM SENSITIVITY OF THE D.C. WHEATSTONE BRIDGE.

S.Stricker.

Bull. Res. Coun. Israel, Vol. C7, No. 1, 51-4 (April, 1959).

The conditions for maximum sensitivity of the d.c. Wheatstone bridge are well known. They are: (1) unity ratio of two bridge arms; (2) matching of the resistances of the galvanometer and the outer circuit; and (3) positioning of the galvanometer between the junction of the high resistance arms and the junction of the low resistance arms. It is shown that all these conditions can be obtained by one simple extremum calculation and an extremum calculation with subsidiary condition. As a point of departure it is assumed that the galvanometer should work at critical damping. Furthermore the calculation is made for one single type of galvanometer. This means that the usual assumption is made that the current sensitivity of the galvanometer is proportional to the root of the galvanometer resistance.

621.317.74

190 DESIGN AND DEVELOPMENT OF A NOISE AND FIELD INTENSITY METER FOR THE 1000 TO 10 000 MEGACYCLE FREQUENCY RANGE. A.Borck and M.Rodriguez.

I.R.E. Nat. Convention Record, Vol. 7, Pt 9, 125-30 (1959).

Describes a portable meter with internal calibration. Four plug-in tuning units are used which contain pre-selector cavities, first mixer and local oscillator. The cavity insertion loss is 1 to 2 dB and the 400 Mc/s i.f. amplifier has a noise figure of about 5 dB. Rejection of 60 dB is obtained. A second i.f. amplifier at 42 Mc/s has band-widths of 1 or 5 Mc/s. A.F.C. is provided. An impulse generator whose accuracy depends only on a d.c. applied voltage and which makes possible measurement of impulse interference in dB above 1 μV $Mc^{-1}s^{-1}$ of impulse band is described. A block diagram is given together with plots of the output voltage spectrum and the output of the impulse generator.

J.S.Young

621.317.74

191 A MEASURING APPARATUS FOR DETERMINING NONLINEARITY IN TRANSMISSION LINES FOR BROADCASTING. E.A.Pavel and M.Bidlingmaier.

Nachrichtentech.Z. (N.T.Z.), Vol.12, No.5, 243-9 (May, 1959). In German.

The signal generating equipment consists of two oscillators with very low harmonic content and good frequency stability. The signal levels are adjustable from +3.3 to −5.5 N, and are directly indicated by a switched instrument. One oscillator produces fixed frequency signals, selected by a switch, of 60, 90, 533 and 800 c/s for single frequency tests, and 4.2 and 5.6 kc/s which are respectively paired with 6.8 and 7.2 kc/s signals from the second oscillator for double frequency (intermodulation) tests. The max. power available is 100 mW into 600Ω. The receiving equipment comprises two amplifiers connected in series, with a frequency range of 30 c/s to 20 kc/s. Between them, and selected by a switch, are two narrow band-pass filters centred on 180 and 1600 c/s. A third switch position inserts a frequency-independent attenuator in place of the filters. A rectifier and sensitive moving-coil instrument are connected to the output circuit of the second amplifier. The lowest range is 0 -0.5% and the highest 0-10%.

C.F.Pizzey

621.317.741 : 621.372.8

192 RECORDING ATTENUATION OF WAVEGUIDE COMPONENTS. G.Edelcreek.

Electronics, Vol. 32, No. 43, 126 (Oct. 23, 1959).

The apparatus is based on the use of two b.w.o's which are swept between 15.5 and 17.5 kMc/s. One of these is used as the primary microwave source, the other as a local oscillator. In addition to the main slow sweep, a fast, small excursion sweep is applied to the local-oscillator b.w.o. to produce a series of i.f. pulses, which are rectified and displayed. The attenuation of the test piece is compared with that of standard having a similar loss. Measurements have covered the range 1 to 80 dB, and a resolution of ± 1 dB is achieved.

E.A.Ash

621.317.742

193 V.S.W.R. INDICATORS WITH AUTOMATIC READ-OUT. M.Kollanyi and R.M.Verran.

Electronic Engng, Vol. 31, 666-71 (Nov., 1959).

An automatic indicator giving a direct read-out either on a meter or a digital display unit can replace the conventional v.s.w.r. indicator with its time taking adjustments. The circuits can be used with any slotted line or equivalent device. A single movement of the probe carriage is all that is necessary for the instrument to supply the correct v.s.w.r. reading. The system described is based on a maximum–minimum detector that detects and stores the extreme values of the voltages encountered during the recording cycle. The ratio of these voltages can be calculated by various electronic methods which are also described. A residual v.s.w.r. of < 1.05 is attainable with a maximum range of v.s.w.r. measurement of 1 : 3 or more if required, although this range depends on the method chosen.

621.317.742

194 A SYSTEM FOR PROVIDING A PRECISE VECTOR VOLTAGE. D.J.Collins and J.E.Smith.

Electronic Engng, Vol. 31, 684-5 (Nov., 1959).

Deals with a possible system for producing a precise vector voltage which can be of any amplitude less than reference and of a phase relationship between 0° and 360°. Such a system is of great use in the calibration of phase shifters and phase measuring devices.

621.317.75

195 AN AMPLITUDE DISTRIBUTION METER. M.Drayson.
Electronic Engng, Vol. 31, 578-84 (Oct., 1959).

The significance of signal amplitude distribution measurements is described, and a brief outline of the mathematical expression of amplitude distribution is given, with particular reference to the approximations involved in any practical measuring system. A novel kind of waveform sampling device has been produced, which permits measurements to a resolution of at least 1%, and an account of this is followed by a detailed description of the circuits associated with it. These provide an instrument suitable for measuring amplitude distributions between the ranges of 0.3 to 30 V amplitude and 0.1 c/s to 10 Mc/s frequency, which will display the amplitude distribution plot of waveforms above 1 kc/s minimum frequency. Photographs of distribution plots on a c.r.t. are shown.

621.317.755

196 SAMPLING OSCILLOGRAPHY. R.Carlson, S.Krakauer, K.Magleby, R.Monnier, V.Van Duzer and R.Woodbury.
I.R.E. WESCON Convention Record, Vol. 3, Pt 8, 44-51 (1959).

Repetitive phenomena at frequencies outside the bandwidth of conventional oscilloscopes may be examined by sampling the input signal with a very short pulse, at a frequency within the bandwidth of a c.r.t. A voltage proportional to the input signal at the time of sampling is applied to the y plates. The value of the sampling frequency is such that the input waveform is sampled each time at a different point in its own cycle. The action is analogous to the use of a stroboscope for inspecting rapid motion. A brief analysis of the method is given. An oscilloscope having a 500 Mc/s bandwidth and a sensitivity of 10 mV/cm is described in detail. An important feature is the application of feedback in the sampling circuits to provide the signal channel with the characteristics of a chopper-type d.c. amplifier. D.E.Rae

621.317.757

197 SPECTRUM ANALYSIS WITH DELAY-LINE FILTERS. H.J.Bickel.
I.R.E. WESCON Convention Record, Vol. 3, Pt 8, 59-67 (1959).

The application of delay-line integration techniques to spectrum analysis is discussed very generally. Briefly the unknown signal is made to traverse a storage loop (length T seconds) where it is heterodyned with a phase advance signal frequency 1/T c/s. All signals in a frequency band 1/T c/s will then be integrated and their relative amplitudes can be displayed on an oscilloscope. The spectrum analyser described can cover a band 10 kc/s wide and with an integration time of 200 ms has a frequency resolution of 5 c/s. It is claimed that theoretically optimum frequency resolution and signal-to-noise ratio enhancement can be achieved. It is stated that centre frequency can be in either the audio, ultrasonic, radio or microwave band. A.P.C.Thiele

621.317.772

198 VIBRATORY PHASE-SENSITIVE AMPLIFIER. L.L.Rotkop.
Priborostroenie, 1959, No. 5, 6-7 (May). In Russian. English translation in: Instrum. Constr., 1959, No. 5, 6-7 (May).

Two circuits are given for a phase-sensitive detector in which the operations normally carried out by diodes connected to RC networks are performed by a vibrating contact. One circuit requires a centre-tapped winding on the input transformer, the other does not. A simple theory is deduced and it is shown that the circuit response is sensitive to both phase and amplitude. Experimental results are quoted for a relay type R.P.7. S.C.Dunn

621.317.772

199 SYSTEMATIC ERRORS IN A NUMERICAL PHASE-METER WITH CONSTANT MEASURING TIME. N.P.Polyakov.
Pribory i Tekh. Eksper., 1959, No. 3, 80-3 (May-June). In Russian.

The action of a phase-meter in which the phase difference between two voltages is converted into a proportional number of pulses occurring within a constant counting (measuring) time is described. The relationship between the frequency band, the measuring time and the counting speed are investigated and systematic errors analysed. P.Collins

621.317.78

200 THE INDUCTRONIC ELECTRODYNAMOMETER FOR THE PRECISE MEASUREMENT OF VOLTAGE, CURRENT, POWER, AND ENERGY. R.F.Estoppey.
Trans. Amer. Inst. Elect. Engrs I, Vol. 78, 393-8 (1959) = Commun. and Electronics, No. 44 (Sept., 1959).
For abstract, see Abstr. 4666 (1959).

621.317.79

201 AN INTERMITTENT-ACTION CAMERA WITH ABSOLUTE TIME CALIBRATION. G.Hefley, R.H.Doherty and E.L.Berger.
I.R.E. WESCON Convention Record, Vol. 3, Pt 6, 129-35 (1959).

A description of a recording system which will simultaneously photograph randomly occurring events and the precise time of each event. The system employs a camera which has a minimum consumption of film but which can complete a framing cycle in 7 ms. The timing system is capable of resolving time to within a few μs. The high framing rate of the camera results from the use of a clutch system between the film drive and a continuously revolving flywheel. The clutch actuation mechanism is similar to a large electrodynamic speaker. When a pulse is applied to a part corresponding to the voice coil, a cone is driven into engagement with the flywheel, thus rotating a small drum in contact with the film, the rotation of the drum pulls one frame of film past the lens opening. The peak power applied to the voice coil is approximately 35 kW. An 88 μF capacitor is discharged through the voice coil by a thyratron and after a short delay is recharged from a 1600 μF reservoir by another thyratron. Consequently, the power supply required to operate the system need cater only for the average current required to maintain the charge on the capacitor reservoir at the maximum duty cycle. The timer is composed of conventional decimal-counting units arranged to count from 10 μs to 31 days, with the count controlled by a precision 100 kc/s standard. Each of the decimal-counting units has a 1-2-2-4 binary output, all of which are read out in parallel by the same pulse used to trigger the camera. To prevent any ambiguity in the read-out due to the binary output changing state, the time of the read-out is controlled by the timer. The read-out is made by the first 100 μs pulse following the event to be recorded. H.A.Miller

621.317.794

202 A COAXIAL FILM BOLOMETER FOR THE MEASUREMENT OF POWER IN THE U.H.F. BAND. I.A.Harris.
Proc. Instn Elect. Engrs, Paper 3146 E, publ. Jan., 1960 (Vol. 107 B, 67-72).

The requirements to be satisfied by a transfer element for the comparison of u.h.f. with d.c. power are stated under the headings of transfer properties and matching and residual losses, and the need for a new type of coaxial bolometer is discussed in the light of them. A coaxial film bolometer which satisfies these requirements for all frequencies between 200 Mc/s and 4 Gc/s is described, and the factors affecting its accuracy are discussed. The range of power that can be handled directly by the instrument is 2-200 mW, the v.s.w.r. relative to 50 ohms is of the order of 0.98 and the uncertainty in measurement is within 1% for powers between 20 and 200 mW. The design is not confined to a particular size. A smaller bolometer element, which handles powers down to 0.1 mW with an upper frequency limit of about 20 Gc/s, and a larger bolometer element, which handles powers up to 2 watts with an upper frequency limit of 3 Gc/s, are feasible.

MAGNETIC DEVICES AND MATERIALS

o21.318.132

203 USE OF THE VOLTAGE–AREA CONCEPT. W.J.Baer.
Bull. Assoc. Suisse Elect., Vol. 50, No. 14, 655-8 (July 4, 1959). In German.

The concept of the voltage-time integral is defined and its relation to the induction in transformer cores recalled. Examples of a voltage–frequency convertor and a counter show the usefulness of the concept. Voltages with rectangular waveforms are particularly suitable for ferromagnetic measurements. R.C.Kell

621.318.22

204 PROGRESS IN PERMANENT-MAGNET MATERIALS. J.E.Gould.
Proc. Instn Elect. Engrs, Paper 3069M, publ. Dec., 1959 (Vol. 106A, 493-9).

The most widely used permanent-magnet materials are at present the field-treated alloys, cast or sintered, of nickel, aluminium, cobalt and iron. Practice and theory have worked together to obtain, in the best of these alloys, an assembly of aligned

single-domain shaped particles in which a very high proportion of the intrinsic magnetization is retained after removal of a magnetizing field and also against high reverse fields. Ceramic-like ferrite magnets have higher coercivity but lower remanence, and the development of these can also be linked with domain theory. Many other alloy materials continue to be used in a limited sphere, but future progress is likely to be linked with the preparation of iron or iron–cobalt particles in elongated single-domain form and the manufacture of permanent magnets from aligned compacts of such particles, as indicated by recent experimental work.

621.318.381

205 A POWERFUL MAGNET FOR LABORATORY PURPOSES. G.Voigt.

Exper. Tech. der Phys., Vol. 7, No. 3, 134-8 (1959). In German.

Describes an electromagnet giving an air-gap induction of 37 kG with a gap of 1.5 cm. The dimensions of the magnet are approximately 1 m^3 and the weight is 4 tons. The windings are cooled by an oil-flow system. A.E.I. Research Laboratory

INDUCTORS . REACTORS RELAYS

621.318.522

206 FUNDAMENTAL DIFFERENCE BETWEEN POLARIZED AND NON-POLARIZED SYSTEMS FOR RELAYS. H.Helmrich.

Elektrotech. Z. (E.T.Z.) A, Vol. 80, No. 16, 536-41 (Aug. 11, 1959). In German.

It is shown by a mathematical treatment based on simple models and equivalent electrical circuits that the power sensitivity (ratio of mechanical work done to electrical power in coil) of a polarized magnet system is at least four times that of a non-polarized system. C.F.Pizzey

621.318.56

207 A NEW HIGH-SPEED DIFFERENTIAL RELAY WITH HARMONIC RESTRAINT. H.Gutmann.

A.E.G. Progress, 1958, No. 4, 333-5.

English translation of a paper already abstracted in Abstr. 4122 (1958).

621.318.56

208 AN INSTRUMENT RELAY WITH A CONTACT PRESSURE AUGMENTING DEVICE AS AN OPERATING ELEMENT IN POWER PLANTS. K.P.Weber.

Elektronik, Vol. 8, No. 10, 311-14 (Oct., 1959). In German.

The measuring element is a d.c. moving-coil system, alternatively, for response to power, an electrodynamometer system. In place of a pointer is an arm carrying at its outer end a small rectangular soft-iron vane. Radially disposed with reference to the moving-coil axis are two flat Mumetal screens. The screens are cut away so that the arm and vane can swing through them with a small clearance. Behind each screen is a d.c.-energized U-shaped electro-magnet. While the vane is between the two screens it is shielded from the flux of the electromagnets. If the moving-coil current alters so that the vane swings through a screen, the vane is subjected to a progressively increasing pull by the corresponding electromagnet, and the arm is pulled hard over and closes the relay contacts. The force on the contacts is at least 2 g. Release is effected by opening the coil circuit of the electromagnet, automatically or manually. The minimum operating power is 0.032 μW; min. current (2000Ω coil), 4 μA; min. voltage (10.5Ω coil), 0.75 mV. Details are given of an adjustable delay circuit, using resistors and capacitors, with a max. delay of 3 sec. C.F.Pizzey

621.318.562.7

209 TRANSISTOR TIME DELAY FOR INDUSTRIAL CONTROL. L.Szmaus and H.Bakes.

Electronics, Vol. 32, No. 39, 74-5 (Sept. 25, 1959).

Two directly coupled transistors of different collector saturation voltages are used with a series CR circuit to effect automatic cycling or synchronous switching of relays. Delay periods between 1.5 and 30 sec are possible. A.Sczaniecki

621.318.562.7

210 TIME RELAY WITH AN INDIRECTLY HEATED SEMICONDUCTOR THERMISTOR. N.M.Tishchenko and N.P.Udalov.

Priborostroenie, 1959, No.5, 12-14 (May). In Russian. English translation in : Instrum. Constr., 1959, No. 5, 12-14 (May).

A design method is described for establishing the behaviour of a time relay controlled by a thermistor, the method being applicable to the particular circuit discussed. A relay designed thus was found to have a delay varying from 158 to 200 sec as the ambient temperature was varied from -10^0 to $+50^0$C, and the supply voltage varied ±10%. D.E.Rae

621.318.57 : 621.374.32

MAGNETIC SWITCHING. See Abstr. 322

621.318.563 : 621.316.925

211 OPEN-PHASE PROTECTION FOR HIGH AND LOW-VOLTAGE MOTORS. H.Gutmann.

A.E.G. Progress, 1958, No. 4, 336-9.

English translation of a paper already abstracted in Abstr. 4126 (1958).

ELECTROSTATICS . CAPACITORS

621.319.32 : 539.17

212 THE OBTAINING OF A BEAM OF MONOENERGETIC PROTONS USING A [2 MeV] VAN DE GRAAFF [ACCELERATOR] AND THE STUDY OF THE RESONANCE CAPTURE OF 1-2 MeV PROTONS BY Mg^{25} AND Mg^{26}. R.Barjon.

Ann. Phys. (Paris), Ser. 13, Vol. 4, No. 5-6, 545-94 (May-June, 1959). In French.

The first part describes the construction of the auxiliary equipment, in particular the h.f. ion source, the electrostatic analyser and its stabilized power supplies and the stabilization of the Van de Graaff itself. As a result, a stable beam of 1-10 μ could be obtained of energy known to 0.2% at energies between 0.5 and 2 MeV. The second part describes the calibration of the accelerator and its use to study the energy levels and resonance capture cross-sections of Al^{26} and Al^{27} using the reactions $Mg^{25}(p,\gamma)Al^{26}$ and $Mg^{26}(p,\gamma)Al^{27}$. J.W.Sturgess

621.319.4

213 PROGRESS IN CAPACITOR TECHNIQUES. G.Soulages.

Bull. Soc. Franc. Elect., Vol. 9, 449-60 (Nov., 1959). In French.

Mechanisms of failure by thermal instability and internal discharges are described and some differences between capacitors with oil and chlorinated impregnants indicated. The reduction in life of capacitors caused by surges of various amplitudes and duration is considered. J.H.Mason

621.319.42

214 METALLIZED-PAPER POWER CAPACITORS. V.T.Renne.

Elektrichestvo, 1959, No. 8, 73-7 (Aug.). In Russian.

Soviet practice in the manufacture of metallized paper capacitors for h.v. d.c. and a.c. is described and concrete design problems are considered. Modern types of German and Swiss capacitors are discussed, and thermal calculations for these types are checked. Some data are also given of certain types produced in Czechoslovakia. The ageing processes in metallized-paper capacitors are surveyed with reference to surge, ionization and tan-δ characteristics. Electrical Research Association

621.319.45

215 CONTINUOUS A.C. OXIDATION OF ANODIC FOIL FOR USE IN ELECTROLYTIC CAPACITORS. B.M.Tareev and M.M.Lerner.

Elektrichestvo, 1959, No. 6, 71-6 (June). In Russian.

Dynamic alternating-current (2- or 3-phase) oxidation of foil for electrolytic capacitors is proposed. Non-oxidizable (e.g. stainless steel, graphite, etc.) baths are to be connected in opposition and filled with the usual aqueous solution of boric acid (30-100 g/litre) and borax (0.05-0.5 g/litre). The scheme described would have the advantage of dispensing with conversion of a.c. into d.c. (the current practice is to use d.c. for oxidation of the electrolytic-capacitor foil). A.Tybulewicz

621.319.53

216 CONTRIBUTION TO THE CALCULATION OF IMPULSE CIRCUITS WITH TWO ENERGY STORAGE SYSTEMS. A.Vondenbusch.

Elektrotech. Z. (E.T.Z.)A, Vol. 80, No. 18, 617-22 (Sept. 11, 1959). In German.

A novel graphical solution is developed of the fundamental equations describing the output wave of a simplified impulse generator circuit. Curves are presented which permit the parameters of the test circuit to be rapidly determined for a prescribed wave shape and for maximum efficiency of the generator output. The curves apply to three different equivalent circuits and their practical application is illustrated by solution of a numerical example.

R.H.Golde

621.319.7 : 537.56

217 A THEORETICAL ANALYSIS OF THE EFFECTS OF AN ELECTRIC FIELD ON THE CHARGING OF FINE PARTICLES. A.T.Murphy, F.T.Adler and G.W.Penney.
Trans Amer. Inst. Elect. Engrs I, Vol. 78, 318-26 (1959) = Commun. and Electronics, No. 44 (Sept., 1959).

Recent measurements of charge imparted to fine particles by unipolar ions in a strong electric field have shown that this charge is appreciably higher than that predicted by previous theoretical analyses. The charge acquired by fine particles is due primarily to ions which strike the particle by virtue of their random heat motion. Previous analyses have assumed that the only field existing was that due to the charge on the particles, thus neglecting any external field which would be present in a corona discharge. Two effects of an external field which influence charging are critically examined: (1) ions or electrons which travel in the direction of the external field toward the particle will acquire energy in addition to their heat energy: their increase in energy will allow these elementary particles to overcome readily the potential field of the charged particle: this effect is shown to be small for molecular ions at atmospheric pressure except for only the very smallest particles but, for charging by free electrons, which have a much longer mean free path, the effect could cause a large increase in charge: (2) the presence of an external field will alter the density distribution of ions around the charged particle since this field opposes the particle field on one side of the particle and aids it on the other side. The general equation for the ion density distribution was not able to be solved. However, approximate finite difference methods using computing machinery show that this effect is important and may almost completely account for the higher charge found with molecular ion charging.

LAMPS . ILLUMINATION

621.327.532 : 628.971

218 POTENTIAL APPLICATION OF THE LINEAR SODIUM LAMP TO STREET LIGHTING. G.K.Lambert.
Light and Lig, Vol. 52, No. 10, 292-7 (Oct., 1959).

The new 200 W Na lamp, which is 3 ft long and has an efficiency of 100 lm/W and a luminance of 16 cd/cm^2 with a single straight tube is specially suitable for street lighting. When mounted with the grooves at the sides, the horizontal luminous intensity is about 30% greater than the vertical intensity. Polar curves of light distribution, obtainable by suitable control of the light from the lamp and designed to suit modern road surfaces, are given. It is considered that satisfactory lighting on dual carriageways should be obtained at a spacing of 180 ft with a mounting height of 35 ft. On main traffic routes the 140 W lamp may be used at a spacing of 150 ft and a mounting height of 30 ft. J.W.T.Walsh

621.327.534 : 621.382.3

219 THE APPLICATION OF POWER TRANSISTORS TO THE OPERATION OF GAS-DISCHARGE LAMPS FROM D.C. SUPPLIES. I.F.Davies and D.Dunthorne.
Proc. Instn Elect. Engrs, Paper 3192U, publ. Jan. 1960, 9 pp. To be republished in Vol. 107A (1960).

The operation of fluorescent tubes on high-frequency (up to 20 kc/s) supplies is considered. The characteristics of sine-wave and square-wave transistor inverters are discussed, and a preference is expressed for sine-wave supplies for lamp operation. Design details and component characteristics for sine-wave lamp inverters are considered and various types of circuit are mentioned.

628.971

220 LAMP REPLACEMENT IN STREET LIGHTING INSTALLATIONS OF LARGE CITIES. W.Spriewald.
Lichttechnik, Vol.11, No.10, 532-5 (Oct., 1959). In German.

Describes the different systems that can be adopted for regular lamp replacement in a large installation, including "group replacement." The relative costs of different systems depend on the type of lamp used, on the costs of energy and of replacement and on the permissible fall in light output due to lamp deterioration, ignoring losses due to dust accumulation and the deterioriation of fittings. The treatment, and the examples given, refer specially to the high-pressure Hg lamp. J.W.T.Walsh

628.971

221 CALCULATING RULE FOR STREET LIGHTING. J.Roch.
Lichttechnik, Vol.11, No.10, 535-7 (Oct., 1959). In German.

Describes a form of calculating rule consisting of four coaxial circular disks with appropriate scales and windows. By its use the average illumination on a roadway can be found from the dimensions of the system, assuming that the light distribution from the fittings used is one of those taken as typical and provided for in the design of the rule. Alternatively, the rule can be used to find the lamp rating needed to provide a specified average illumination.

J.W.T.Walsh

628.971 : 621.327.532

POTENTIAL APPLICATION OF THE LINEAR SODIUM LAMP TO STREET LIGHTING. See Abstr. 218

628.971

222 INSTRUMENT FOR DEMONSTRATING GLARE FROM A STREET LIGHTING SYSTEM. F.W.Müller.
Lichttechnik, Vol.11, No.10, 538-40 (Oct., 1959). In German.

A photographic representation of a lighted street is shown to an observer who is provided with controls with which he can modify the appearance of the scene by (a) altering the brightness of the lighting fittings; (c) altering the size of the visible bright portion of each fitting; (d) altering the brightness of the shop windows on both sides of the street; and (e) switching on or off the headlights of a car in the middle distance. The instrument is used to show how the various factors affect the glare experienced in a street at night.

J.W.T.Walsh

628.972

223 DEVELOPMENT AND USE OF A QUANTITATIVE METHOD FOR SPECIFICATION OF INTERIOR ILLUMINATION LEVELS ON THE BASIS OF PERFORMANCE DATA. H.R.Blackwell.
Illum. Engng, Vol. 54, No. 6, 317-53 (June, 1959).

Describes a method for determining the illumination needed for different visual tasks. Performance curves are found in the laboratory for the detection of a 4 min. test disk with 99% certainty. "Field factors" are applied to compensate for differences between laboratory and field conditions. Any actual visual task is compared with the laboratory task in a Visual Task Evaluator, in which both tasks are reduced to threshold visibility by a contrast reducing device. In this way the contrast of the test object which makes it equivalent to the actual task is found. With this information, the performance curves give the luminance necessary for a specified visual performance and the corresponding illumination can be deduced. The illumination values needed for 56 typical visual tasks have been thus determined. J.W.T.Walsh

628.972

224 A DISCOMFORT GLARE EVALUATOR. S.K.Guth and J.F.McNelis.
Illum. Engng, Vol. 54, No. 6, 398-406 (June, 1959).

This is an instrument in which the observer compares the visual discomfort produced by a given lighting system with that produced by a small comparison source (0.0004 sr). The latter is adjusted in luminance until, when viewed alternately with the lighting system for a second at a time, the discomfort is judged to be the same. The instrument has been used to examine Fry's method of rating groups of sources for discomfort (see Abstr. 4347 of 1957). J.W.T.Walsh

628.972

225 PHYSICAL MEASUREMENTS FOR THE DETERMINATION OF BRIGHTNESS AND CONTRAST. D.M.Finch.
Illum. Engng, Vol. 54, No. 8, 474-81 (Aug., 1959).

Part I of an investigation of the effect of specular reflection on visibility. Luminance contrasts in three reading tasks under different conditions as regards lighting and viewing were measured. Two types of microphotometer were used and results are given as curves of luminance (brightness) factor at various angles of incidence, with a constant viewing angle of 25° from normal. Contrast

is defined as $(B_1 - B_2)/B_1$ where B_1 is the luminance of the background (paper) and B_2 that of the writing (ink or pencil).

J.W.T.Walsh

628.972

226 FIELD MEASUREMENTS OF LOSS OF CONTRAST
J.M.Chorlton and H.F.Davidson.
Illum. Engng, Vol. 54, No. 8, 482-8 (Aug., 1959).

Part II of an investigation. For Part I, see preceding abstract. By means of a visibility meter the loss in apparent contrast due to glare was measured for a series of reading tasks illuminated by different lighting systems. The measurements were made at a number of different values of illumination on the task.

J.W.T.Walsh

628.972

227 NEW CHARTS FOR BRIGHTNESS CONTRAST CALCULATIONS. I.Goodbar.
Illum. Engng, Vol. 54, No. 8, 489-99 (Aug., 1959).

Complementary to the work described in the two preceding abstracts. From Finch's curves of luminance (brightness) factors it is possible to construct diagrams by means of which the contrasts can be calculated easily for any given lighting system of normal design. Such diagrams are reproduced for pencil lines and for matt white paper and their use for finding contrasts in the case of a particular lighting system is described. J.W.T.Walsh

628.972

228 THE PERMANENT SUPPLEMENTARY ARTIFICIAL LIGHTING OF INTERIORS.
R.G.Hopkinson and J.Longmore.
Trans. Illum. Engng Soc., Vol. 24, No. 3, 121-48 (1959).

Experimental studies have been made to determine the levels of supplementary lighting that are necessary for a good integration of daylight and artificial light. The results of these studies are applied to a new technical college and to an agricultural research laboratory.

ELECTROCHEMISTRY

621.355

229 BATTERY IMPEDANCE — FARADS, MILLIOHMS, MICROHENRIES. E.Willihnganz and P.Rohner.
Elect. Engng, Vol. 78, No. 9, 922-5 (Sept., 1959).

Describes the equivalent circuit of a battery consisting of a resistance, inductance and capacitance and describes a Wheatstone bridge method with a variable-frequency oscillator for measuring these components in a series of telephone-type lead—calcium batteries. It is pointed out that measured resistance varies with the method used and indicates that when resistance is mentioned, the method should be specified. The capacitance of a battery is in the range of one farad to several hundred farads, depending on size and test frequency. The resistance will be 0.1 to 10 milliohms, depending on the battery size, and the inductance will be less than 0.1 microhenry. W.A.Walker

621.357.5

230 ELECTROFORMING OF INTRICATE ELECTRONIC COMPONENTS. E.B.Murphy.
Electronics, Vol. 32, No. 37, 114-17 (Sept. 11, 1959).

Electroforming techniques are described with relation to the production of microwave transmission equipment. Parts impossible or costly to make by normal methods can be produced economically by electroforming. Formers of aluminium, stainless steel and plastics and their removal from the electroformed components are described. The levelling and stress-relieving action of periodic reverse-current plating is discussed. 6 references.

W.A.Walker

621.357.7

231 THERMAL EVAPORATED THIN FILMS.
F.Ura.
I.R.E. WESCON Convention Record, Vol. 3, Pt 6, 72-6 (1959).

Describes the vacuum deposition process in general and deals with aspects such as cleanliness and surface condition of the substrate (the material on which it is desired to deposit a film), emission of gas, heating of substrate, control and measurement of film thickness, and contacts. H.A.Miller

ELECTRIC HEATING

621.36

232 CONVERSION OF ENERGY BY THE SEEBECK EFFECT, AND REFRIGERATION BY THE PELTIER EFFECT. Nguyen Thien-Chi, J.Vergnolle and B.Donnadille.
Ann. Radioelect., Vol. 14, 275-321 (Oct., 1959). In French.

After a general theoretical investigation of the use of a thermocouple (a) as an electrical generator, and (b) as a refrigerator using the Peltier effect, the technical and engineering aspects of the problem are discussed, and some experimental results using semiconductors are given. P.M.Davidson

621.362

233 THERMOELECTRIC POWER. AN INVESTIGATION OF ITS POSSIBILITIES. I-III.
G.W.Wilson and B.C.Lindley.
Engineering (London), Vol. 188, 97-9 (Aug. 28); 129-32 (Sept. 4); 161-2 (Sept. 11, 1959).

Part I deals with the fundamental principles of thermionic and thermoelectric generators. Part II considers the engineering design parameters and performance of proposed generating systems. Part III is devoted to a general discussion and an approximate analysis of the economics involved. 21 refs.

Central Electricity Generating Board Digest

621.362

234 THERMOELECTRIC SPOT COOLING APPLICATIONS.
E.W.Frantti, R.S.Lackey and H.A.Wagner.
I.R.E. WESCON Convention Record, Vol.3, Pt 6, 136-40 (1959).

Devices for producing local controlled cooling have several applications; for example, cooling an infrared detector cell increases its sensitivity by lowering the background noise. Some devices in which the cooling is produced by thermoelectric methods are described in detail. P.M.Davidson

621.365.2

235 ARC-FURNACE PERFORMANCE STUDIED WITH MODELS. Yu.E.Efroimovich.
Elektrichestvo, 1959, No. 8, 45-51 (Aug.). In Russian.

Solutions are considered of problems which arise in connection with methods which would allow: (a) calculation of the electrical conditions in an arc furnace with given values and ratios of arc voltage, current or useful phase capacity; (b) selection, from the maximum number of combinations of currents, voltages and phase capacities for a given rational system, of the finite number of their combinations which will adequately characterize the conditions of redistribution of useful power between furnace phases for various disparities of arc voltage and current; and (c) the linking-up of any particular electrical performance with the thermal and economic conditions of furnace operation.

Central Electricity Generating Board Digest

621.365.4

236 ELECTRIC BRIDGE HEATING.
M.Moosberger.
Elektrizitätsverwertung, Vol. 34, No. 9, 239-43 (Sept., 1959).
In German.

In order to avoid ice formation on roadway surfaces five new pre-stressed concrete bridges in Switzerland have been fitted with specially designed heaters. These are in the form of wire netting embedded in the concrete; loading is approximately 125 W/yd^2 at 25 V and the elements are raised to a temperature of 10°C. This method is more expensive than salt spraying but helps to avoid traffic congestion and accidents. E.H.Dock

ELECTRIC WAVES AND OSCILLATIONS

621.371

237 REMOTE CONTROL BY "NEAR" MAGNETIC FIELD. J.J.Hupert.

Electronic Industr., Vol. 18, No. 7, 82-5 (July, 1959).

The induction field is compared with the radiation field and its characteristics studied. The pattern of the near electric field is similar to that of the far field but its intensity is lower than that of the near magnetic field. The polarization of the near magnetic field is elliptical but at very near distances it becomes linear again. Plots of the magnetic field for the two conditions are given and optimum orientation for the receiving aerials indicated.

H.G.M.Spratt

LINES . NETWORKS . FILTERS

621.372

238 TRANSMISSION OF ELECTROMAGNETIC WAVES THROUGH WIRE GRATINGS (THEORY). J.K.Skwirzynski and J.C.Thackray.

Marconi Rev., Vol. 22, 77-90 (2nd Qtr, 1959).

The transmission properties of a plane polarized electromagnetic wave passed through a grating of cylindrical wires are considered. Only the case of normal incidence is treated, but a full theory is provided for a general angle of incidence. The transmission coefficient curves (amplitude and phase) cover wide ranges of the grating parameters and, by using normalization, frequency. A possible application of the results to the design of waveguide filters, containing cylindrical inductive posts, is also given.

621.372

239 TRANSMISSION OF ELECTROMAGNETIC WAVES THROUGH WIRE GRATINGS (EXPERIMENTAL). E.G.A.Goodall and J.A.C.Jackson.

Marconi Rev., Vol. 22, 91-8 (2nd Qtr, 1959).

See also preceding abstract. An experimental investigation into the transmission of vertically polarized electromagnetic waves through a plane vertical grating of circular cross-section wires has been made. A comparison is made between experimental and theoretical values of power transmitted at normal incidence for gratings with wire diameters such that $d\% = 2$ and $5[d\% = 100(d/\lambda)]$. A measurement has also been made of the power transmitted through a wire grating for $d\% = 2$, for angles of incidence between 5° and 50°.

621.372 : 621.315.61

ON RAISING THE FREQUENCY BANDWIDTH OF THIN "λ/4-LAYER" ABSORBERS FOR ELECTROMAGNETIC CENTIMETRE WAVES. See Abstr. 148

621.372.2

240 DETERMINATION OF THE WAVE PROPAGATION CONSTANT FOR A LONG LINE. S.P.Belousov and V.G.Yampol'skii.

Radioteknika, Vol. 14, No. 7, 3-7 (July, 1959). In Russian.

Starts from the accurate equation for the propagation constant of a line parallel to the boundary between two media as given by Grinberg and Bonshtedt (see Abstr. 4261 of 1954), and deduces a fairly simple method of approximate solution equally applicable to the long, short, or ultra-short wave-bands. For convenience, graphs are included of the various coefficients that appear in the final formula.

D.E.Brown

621.372.412

241 DESIGN OF OPEN-ENDED MICROWAVE RESONANT CAVITIES. D.C.Thorn and A.W.Straiton.

I.R.E. Trans Microwave Theory and Tech., Vol. MTT-7, No. 3, 389-90 (July, 1959).

A method of dispensing with the end plates of microwave cavities by terminating the cavities with short sections which are partitioned so that each subdivision is a waveguide below cut-off is discussed. The basic principles are examined and rectangular and cylindrical cavities using these principles are described.

R.C.Glass

621.372.413

242 END PLATE MODIFICATION OF X-BAND TE_{011} CAVITY RESONATORS. M.C.Thompson, Jr., F.E.Freethey and D.M.Waters.

I.R.E. Trans Microwave Theory and Tech., Vol. MTT-7, No. 3, 388-9 (July, 1959).

The effect on the Q of a cylindrical X-band cavity of opening up the end plates was investigated. The end plates consisted of an inner ring supported by struts from an outer ring resting on the cavity walls. The effect of ring and strut thickness and ring radius, length and position was studied. The results show that Q values of about 8000 can be obtained when more than 92% of the end plate is removed provided the remaining parts of the end plates are correctly located.

R.C.Glass

621.372.5

243 AN EFFICIENT FOURIER APPROXIMATION IN THE [CASE OF] LIMITED BANDWIDTH. S.Yamada.

J. Inst. Elect. Commun. Engrs Japan, Vol. 42, No. 7, 697-701 (July, 1959). In Japanese.

In determining the frequency characteristics of a system with limited bandwidth, the approximation used may be inexact owing to the unknown characteristics outside the band used. A simple method of deriving a function which gives a closer approximation is described and applied to practical examples.

A.Wilkinson

621.372.5

244 CLASSES OF 4-POLE NETWORKS HAVING NON-LINEAR TRANSFER CHARACTERISTICS BUT LINEAR ITERATIVE IMPEDANCES. E.C.Cherry.

Proc. Instn Elect. Engrs, Paper 3114E, publ. Jan., 1960 (Vol. 107B, 26-30).

The conventional representation of an electric circuit as a pattern of branches, nodes and meshes (topological graph) is historic. The less familiar representation as a set of contiguous rectangles, proposed by the author in 1951 from a suggestion made by Hering [Elektro-Journal, Vol. 7, p. 17, 51 and 98 (1927)], has many conceptual advantages; not only does it represent the network pattern topologically but it displays other physical properties: the dual of the circuit is included; the element energies and co-energies (energy duals) are shown; current and voltage magnitudes are represented, etc. This rectangle representation of a planar circuit is briefly reviewed and its special application to non-linear circuits is explained. From simple geometrical symmetry of the rectangle diagrams it becomes immediately obvious that iterative structures (lattices,bridged-T, etc.) may be constructed from dual non-linear resistive elements having linear iterative impedances. If these can be constructed practically, they might be connected in cascade, without mutual interaction, as non-linear equalizers analogous to Zobel's constant-resistance phase-equalizers. The analogy to Zobel's networks is shown to be surprisingly complete, though the author can yet find no physical relation between these and the present non-linear networks.

621.372.54

245 NETWORKS FORMING PULSES WITH WAVE-TOP SHAPES OF CHEBŸSHEV TYPE. K.Hatori.

J.Inst. Elect. Commun. Engrs Japan, Vol.42, No.8, 754-8 (Aug., 1959). In Japanese.

The design is discussed of networks producing pulses with small overshoots and short rise and fall times, the amplitudes of the ripples in the tops of the pulses being all equal. The normalized values of the elements of the networks designed by this method are tabulated and the relations between the amplitude of the ripples in the pulse top, the relative rise and fall times, and the number of elements used in the network, are illustrated. A pulse with a wave-top shape of Chebŷshev type, obtained with an experimental network, is shown as an example.

A.Wilkinson

621.372.54

246 A PRACTICAL ELECTRO-MECHANICAL FILTER. H.Bache.

Marconi Rev., Vol. 22, 144-53 (3rd Qtr, 1959).

Discusses the manufacture of electro-mechanical filters employing mechanical elements operating in the torsional mode. As an example, a component used as an upper side-band filter for a carrier frequency of 250 kc/s is described. The importance of having material for both the element and the transducer systems in the correct state before manufacture commences is emphasized.

These filters are useful in applications where small size, rigidity, low loss and stability (particularly with changes in temperature) are required. In the present design any input or output impedance between 300Ω and 100 kΩ may be obtained. Bandwidths up to about 3% in the range of 100 to 500 kc/s can be accommodated, though changes in these two parameters may involve re-tooling for each filter type. The complete assembly is contained in a sealed metal container, no adjustments being necessary in service. The maximum input level is approximately 1 mW (i.e., 5.5 V r.m.s. for 30 kΩ) above which non-linearity between input and output starts.

621.372.542.2

247 OPTIMUM BY TCHEBYCHEFF THIRD-ORDER FILTERS. H.S.Heaps and L.J.Mason.

Electronic Radio Engr, Vol. 36, No. 10, 388-91 (Oct., 1959).

An analysis is presented to determine the optimum design of a Chebyshev low-pass third-order filter to detect a rectangular pulsed signal upon a background of white noise. It is found that for a given length of input pulse the signal-to-noise ratio in a sample of the output is almost independent of the value of the filter parameter (chosen between zero and unity). The ratio of output signal energy to output-noise energy is calculated for output samples that contain given percentages of the total available output-signal energy. The optimum Chebyshev filter produces signal-to-noise ratios which are not quite as large as those obtained by use of the optimum Butterworth filter considered in a previous paper (see Abstr. 4274 of 1958).

621.372.543.2

248 HOW TO DESIGN BANDPASS TRIPLES. R.B.Hirsch.

Electronics, Vol. 32, No. 34, 41-2, 44 (Aug. 21, 1959).

By analysing the transfer impedance of a simple low-pass filter and applying a frequency transformation to the expression, a bandpass filter with three poles can be defined. This method is used to obtain formulae for the design of triple-tuned bandpass filters. V.G.Welsby

621.372.543.2

249 A NEW COAXIAL RESONATOR FILTER. K.G.Dean and A.G.Hancock.

Proc. Instn Elect. Engrs Australia, Vol. 20, No. 10, 622-31 (Oct., 1959).

A new type of band-pass filter using loop-coupled coaxial resonators, which has an m-derived type of characteristic, is described. A design analysis is given and it is shown that the performance may be described in terms of an equivalent lattice network; good agreement is shown between the insertion-loss characteristic of an experimental filter and the calculated performance.

621.372.552 : 621.372.8

DELAY DISTORTION AND EQUALIZATION IN H_{01} WAVEGUIDES FOR LONG-RANGE COMMUNICATION. See Abstr. 258

621.372.57

250 ANALYZING NETWORKS WITH THE Y-MATRIX. W.J.D.Steenaart.

Electronic Industr., Vol. 18, No. 7, 86-9 (July, 1959).

Small-signal analysis of active circuits can be simplified by applying the concepts of matrix algebra, particularly where cascaded stages are concerned. This is illustrated by examples showing the application of the method to transistor circuits. V.G.Welsby

621.372.6

251 THE COMPLEX INSTANTANEOUS FREQUENCY. ITS DEFINITION AND MEASUREMENT. P.Braffort and R.Castagne.

C.R. Acad. Sci. (Paris), Vol. 249, No. 7, 654-7 (Aug. 17, 1959). In French.

If $s(t)$ and $\sigma(t)$ are orthogonal solutions of the characteristic equation of a variable frequency signal, the complex instantaneous frequency is defined as $\frac{1}{2\pi}\frac{d}{dt}[\log\{s(t) + j\sigma(t)\}]$. Since $\sigma(t)$ has a functional dependence on $s(t)$ it cannot be measured exactly. However, to within an error comparable with the noise level, it could be found by allowing the signal $s(t)$ to effect a single-sideband modulation of a carrier and examining the resultant modulation spectrum {which is in quadrature with $s(t)$}. G.D.Sims

621.372.6

252 SOME TEST FOR THE NUMBER OF POSITIVE ZEROS AND FOR THE NUMBERS OF REAL AND COMPLEX ZEROS OF A REAL POLYNOMIAL. O.P.D.Cutteridge.

Proc. Instn Elect. Engrs, Monogr. 350M, publ. Dec., 1959, 6 pp. To be republished in Part C.

The numbers of positive, real and complex zeros of a polynomial with real coefficients are shown to be related to the number of changes in sign along one or two sequences of determinants whose elements consist of the coefficients of the given polynomial and of its derivative. This in turn is related to the number of negative signs occurring in a certain continued fraction. Some numerical examples illustrate the application of both methods, and the simplification of and the relationship between the two sequences of determinants is also discussed.

621.372.6 : 621.391

253 ON THE OPTIMUM SYNTHESIS OF MULTIPOLE CONTROL SYSTEMS IN THE WEINER SENSE. H.C.Hsieh and C.T.Leondes.

I.R.E. Nat. Convention Record, Vol. 7, Pt 4, 18-31 (1959).

Gives a method for the optimum synthesis, in the Weiner sense, of a multipole whose transfer matrix is of order $m \times n$. The problem is first solved for the case where there is no correlation between the inputs and the optimum weighting functions and the mean square error is derived. The case of correlated inputs is then considered by a method avoiding the difficulties commonly experienced with variational techniques. The problem is reduced to a set of ordinary algebraic equations which yield the optimum physically realizable transfer functions. G.D.Sims

621.372.6

254 SYNTHESIS OF DISTRIBUTED-CONSTANT NETWORKS. N.Ikeno.

J. Inst. Elect. Commun. Engrs Japan, Vol. 42, No. 6, 585-91 (June, 1959). In Japanese.

Network configurations including no series connections are suitable for distributed-constant networks because they are easy to realize. The author has previously proved that if the attenuation poles of such a network are restricted to the real and imaginary axes, except the region of $1 > \lambda > -1$ on the λ-plane, the network can be synthesized as one comprising not more than 4 element loops. Theory is here given with reference to the extension of the region of attenuation poles to almost the whole of the complex plane, the phase characteristic being assumed arbitrary. The inhibited region is only the segment $1 > \lambda > -1$ on the real axis. Network configurations suitable for filter networks of the lumped-constant ladder type are also discussed. It is shown that any desired network can be synthesized as a tandem connection of partial networks having only three parallel paths. A.Wilkinson

WAVEGUIDES

621.372.8 : 621.396.65 : 621.396.2

255 AN INTRODUCTION TO WAVEGUIDES AND MICROWAVE RADIO SYSTEMS.

Pap. Instn Post Off. Elect. Engrs, No. 214, 23 pp. (rec. Dec., 1959).

621.372.8 : 621.317.34

256 AN EXPERIMENTAL INVESTIGATION OF WAVEGUIDES FOR LONG-DISTANCE TRANSMISSION. A.E.Karbowiak and V.H.Knight.

Proc. Instn Elect. Engrs, Paper 2931 E [Convention on Long-distance Transmission by Waveguides] publ. 1959 (Part B Suppl. No. 13, 17-29).

Records the results of a series of measurements carried out on waveguides and components of the type suitable for long-distance transmission. The description opens with a short discussion of methods of measurement, their applications and shortcomings. The reasons for choosing a pulse-testing method are explained, and the special equipment is briefly described. The measurement difficulties are discussed in detail, and some apparently conflicting results are explained. The problem of mode identification is tackled in a number of ways, and some experimental results are recorded. A number of components are studied and particular attention is paid to the feeds. Bends and corners are investigated in some detail, and it is claimed that, with suitably designed waveguides, these need not be a major design problem. In fact, using the techniques des-

cribed, very satisfactory bens and corners can be made with relative ease. Some abridged results of numerous measurements carried out on plain metallic pipes under various conditions are recorded, and it is concluded that such waveguides are unsuitable for long-distance transmission. Performance figures of corrugated and helical waveguides are quoted, and it is concluded that electrically satisfactory waveguides can be designed.

621.372.8 : 621.774

257 WAVEGUIDE FOR CIRCULAR ELECTRIC MODE TRANSMISSION. A. C. Beck and C. F. P. Rose.

Proc. Instn Elect. Engrs, Paper 3005E [Convention on Long-Distance Transmission by Waveguide] publ. 1959 (Part B Suppl. No. 13, 159-62).

Low-loss circular electric mode transmission over long distances imposes special requirements on waveguide structure. In addition to close dimensional tolerances, small random deviations in straightness approximating the 2 or 3 ft beat wavelength must be prevented to avoid unwanted mode conversions. This made it necessary to improve methods for manufacturing solid-walled copper and copper-lined steel waveguide tubing. Helix waveguide with improved mechanical and electrical transmission properties has also been developed. This is made experimentally by winding a coil of fine wire on a mandrel, applying a lossy jacket over it, encapsulating the assembly in a steel tube with a thermosetting resin and finally extracting the mandrel. Techniques for joining sections into long test runs involve accurately threaded butt joints with vacuum and pressure-tight couplings. Facilities for testing such waveguide systems have been installed at the Holmdel Laboratory.

621.372.8 : 621.372.552

258 DELAY DISTORTION AND EQUALIZATION IN H_{01} WAVEGUIDES FOR LONG-RANGE COMMUNICATION. H.Larsen.

Proc. Instn Elect. Engrs, Paper 2917 E [Convention on Long-Distance Transmission by Waveguide], publ. 1959 (Part B Suppl. No. 13, 188-94).

Using a p.c.m. system, a simple relationship is discussed for the limit length of a regeneration section. This reveals that delay equalization is required in the lower part of the transmission range between 35 and 80 Gc/s, if the regeneration sections are to coincide with the usable repeater spans. The number of delay-equalizer elements required is derived from a general relationship containing the field energy of the equalizer. A specific equalizer of the low-pass type would have to include about 145 elements for the equalization of a waveguide run of 30 km (50 mm guide diameter) with 35 Gc/s and 75 Mc/s separation from low-pass resonance, and about 49 elements when operated at an intermediate frequency of 4 Gc/s. The attenuation distortion narrows the usable bandwidth. It is investigated whether frequency modulation can be used, in view of the phase distortion caused by reflection and mode conversion. If the investigation is restricted to the H_{01} reflections and H_{01}/H_{02} conversion at the diameter discontinuities of the partial lengths, it is found that the permissible distortion limit is already attained with a route 1000 km long consisting of 5 m segments with diameter tolerances of 0.1%. Since conversion is caused by effects other than those considered, frequency modulation shows promise only for minor route lengths.

621.372.8 : 621.317.741

RECORDING ATTENUATION OF WAVEGUIDE COMPONENTS. See Abstr. 192

621.372.81

259 INTRODUCTORY SURVEY [TO LONG-DISTANCE TRANSMISSION BY WAVEGUIDE]. H.E.M.Barlow.

Proc.Instn Elect. Engrs, Paper 2820 R [Convention on Long-distance Transmission by Waveguide], publ. Jan., 1959 (Part B Suppl. No.13, 1-7, 8).

Republication with discussion, of the paper abstracted in Abstr. 1579 (1959).

621.372.81

260 DISTORTION OF INFORMATION IN NON-UNIFORM MULTI-MODE WAVEGUIDES. A.E.Karbowiak.

Proc. Instn Elect. Engrs, Paper 2772R [Convention on Long-Distance Transmission by Waveguide], publ. Jan., 1959 (Part B Suppl. No. 13, 9-16, 57-61).

Republication, with discussion, of the paper abstracted in Abstr. 287 (1959).

621.372.81

261 ASSESSMENT OF WAVEGUIDE PERFORMANCE AS A LONG-DISTANCE TRANSMISSION MEDIUM. A.E.Karbowiak.

Proc. Instn Elect. Engrs, Paper 2862R [Convention on Long-Distance Transmission by Waveguide], publ. 1959 (Part B Suppl. No. 13, 168-85).

The problems connected with the design of waveguides suitable for long-distance transmission are briefly analysed, and features peculiar to this transmission medium are contrasted with those of the more conventional kind. All known types of waveguides are discussed and their properties are analysed in detail; it is demonstrated conclusively that the only waveguides suitable for long-distance transmission are the dielectric-coated waveguide and the anisotropic waveguide, of which there are several distinct types. Design formulae for these are given and analysed at length. An extensive quantitative discussion of typical waveguide discontinuities is given, and the mechanism of mode conversion-reconversion, responsible in large measure for signal distortion, is explained. It is shown how to design suitable waveguides (dielectric coated or anisotropic) to counteract these effects successfully. Some examples are given.

621.372.81

262 WAVEGUIDE AS A LONG DISTANCE COMMUNICATION MEDIUM. A.E.Karbowiak.

Electronic Engng, Vol. 31, 520-5 (Sept., 1959).

See preceding abstract.

621.372.82 : 621.317.729.3

SPINNING-DIPOLE TECHNIQUE APPLIED TO THE MEASUREMENT OF WAVEGUIDE MODES. See Abstr. 188

621.372.821.2

263 PROPERTIES OF THE H-GUIDE AT MICROWAVE AND MILLIMETRE-WAVE REGIONS. F.J.Tischer.

Proc. Instn Elect. Engrs, Paper 2834 R [Convention on Long-Distance Transmission by Waveguide] publ. Jan., 1959 (Part B Suppl. No.13, 47-53, 57-61).

Republication, with discussion, of the paper abstracted in Abstr. 902 (1959).

621.372.822 : 621.317.373

264 PHASE MEASUREMENTS THROUGH TAPERED JUNCTIONS. L.Lewin.

Proc. Instn Elect. Engrs, Paper 2854 R, publ. Sept., 1959 (Vol. 106 B, 495-6).

If a tapered section is suitably matched at the transitions between two uniform waveguides, the electrical length of the taper is usually taken to be its physical length. It is shown here that a small correction is necessary on account of the cylindrical nature of the wave which propagates in the taper region, and a simple expression for the correction is found for a rectangular waveguide in the dominant mode.

621.372.823

265 TRANSMISSION DEVIATIONS IN WAVEGUIDE DUE TO MODE CONVERSION: THEORY AND EXPERIMENT. H.E.Rowe and W.D.Warters.

Proc. Instn Elect. Engrs. Paper, 3001 E [Convention on Long-Distance Transmission by Waveguide] publ. 1959 (Part B Suppl. No. 13, 30-6).

Coupling to spurious modes at imperfections in a long circular waveguide may cause the TE_{01} loss to increase and to fluctuate randomly with frequency. The statistical properties of the TE_{01} loss/frequency curve can be expressed in terms of the statistical properties of the random geometric imperfections of the guide and therefore in terms of its mechanical tolerances. Such imperfections as poor joints and elliptical waveguide have negligible effect under reasonable tolerances. However, random deviations of the guide axis from a straight line may have very serious effects under certain conditions. The use of mode filters or of helix waveguide to increase the spurious-mode loss reduces the TE_{01} loss fluctuations but leaves the average TE_{01} loss due to mode conversion relatively unaffected. Experimental measurements of loss/frequency curves of spurious-mode content and of mechanical tolerances which have been made on existing waveguides support these conclusions. Random straightness deviations introduced during manufacture of the waveguide are the primary cause of the observed transmission behaviour.

621.372.823 : 621.317.34

266 A SURVEY OF METHODS USED TO INDENTIFY MICROWAVE FIELDS OR WAVE MODES IN CYLINDRICAL WAVEGUIDES. H.G.Effemey.
Proc. Instn Elect. Engrs, Paper 2837 R [Convention on Long-Distance Transmission by Waveguide], publ. Jan., 1959 (Part B Suppl. No. 13, 75-83, 97-9).

Republication, with discussion, of the paper abstracted in Abstr. 1580 (1959).

621.372.823 : 621.317.341

267 RESEARCHES ON TRANSMISSION OF TE_{01} WAVES IN CIRCULAR WAVEGUIDES IN THE VICINITY OF 25 AND 35 Gc/s. M. Thué, J. Bendayan and G. Comte.
Proc. Instn Elect. Engrs, Paper 3011E [Convention on Long-Distance Transmission by Waveguide] publ.1959. (Part B Suppl. No. 13, 94-6).

The characteristics of two 50 m lengths of straight circular waveguide have been measured at 25 and 35 Gc/s. The first line was made from solid copper tube of 50 mm bore by drawing to an overall tolerance, including ovality, of ±0.03 mm. The second line was composed of helical waveguides obtained by winding rectangular copper wire on a precision mandrel and surrounding it by a sheet of plastic material reinforced with glass fibre: the bore and overall tolerances were again 50 mm and ±0.03 mm. With the two lines short-circuited at both ends, , measurements were made with 0.02 microsec pulses; for favourable settings of short-circuiting piston, attenuations as low as 0.3 neper/km at 35 Gc/s and 0.6 neper/km at 25 Gc/s have been measured on both lines, these results exceeding the theoretical attenuation by only 25-40%. A third line, made of flexible helical waveguide of 50 mm bore, was bent with radius of curvature extending from 50 to 1000 m; attenuation measurements showed that the losses of the TM_{11} wave were 1500 times higher than those of the TE_{01} wave at 35 Gc/s, and 500 times at 25 Gc/s.

621.372.823

268 EXPERIMENTS ON CIRCULAR H_{01} WAVE PROPAGATION IN A CURVED WAVEGUIDE FILLED WITH AN INHOMOGENEOUS DIELECTRIC.
H.E.M.Barlow and D.C.Rickard.
Proc. Instn Elect. Engrs, Paper 2841R [Convention on Long-Distance Transmission by Waveguide], publ. Jan., 1959 (Part B Suppl. No. 13, 106-7).

Republication, with discussion, of the paper abstracted in Abstr. 909 (1959).

621.372.823

269 DESIGN OF A TWO-SECTION CONICAL TAPER IN CIRCULAR WAVEGUIDE SYSTEM SUPPORTING THE H_{01} MODE. L.Solymar.
Proc. Instn Elect. Engrs, Paper 2833R [Convention on Long-Distance Transmission by Waveguide], publ. Jan., 1959 (Part B Suppl. No. 13, 121-8, 145-50).

Republication, with discussion, of the paper abstracted in Abstr. 908 (1959).

621.372.823

270 WINDING AND JOINING HELICAL-WOUND WAVEGUIDE. L.Lewin.
Proc. Instn Elect. Engrs, Paper 2826R (Convention on Long-Distance Transmission by Waveguide) publ. Jan., 1959 (Part B Suppl. No. 13, 156-8, 163-5).

Republication, with discussion, of the paper abstracted in Abstr. 907 (1959).

621.372.823 : 621.317.34

TESTING OF CIRCULAR WAVEGUIDES USING A RESONANT CAVITY METHOD. See Abstr. 165

621.372.823.2 : 621.317.34

271 AN EQUIPMENT FOR MEASURING THE ATTENUATION OF LOW-LOSS WAVEGUIDE TRANSMISSION LINES.
D.G.Keith-Walker.
Proc. Instn Elect. Engrs, Paper 2838 R [Convention on Long-Distance Transmission by Waveguide]. publ. Jan., 1959 (Part B Suppl. No.13, 71-4, 97-9).

Republication with discussion, of the paper abstracted in Abstr. 1582 (1959).

621.372.824

272 CHARACTERISTIC IMPEDANCE OF SPLIT COAXIAL LINE. H.Kogō.
I.R.E. Trans Microwave Theory and Tech., Vol. MTT-7, No. 3, 393-4 (July, 1959).

A recent paper (see Abstr. 3047 of 1958) has advanced theoretical values for the characteristic impedance of coaxial lines having two diametrically opposed longitudinal slots, and outer tube of appreciable thickness. These values differ from those previously published (Abstr. 914 of 1955; 2527 of 1956). The differences in the theories advanced are discussed. Values of Z_0 are plotted for several types of line, and these are in good agreement with those deduced from water tank measurements. W.T.Blackband

671.372.824

273 CHARACTERISTIC IMPEDANCES OF THE SLOTTED COAXIAL LINE. Lin Wei-guan.
Science Record (China), Vol. 3, No. 11, 583-91 (Nov., 1959).

The characteristic impedances of slotted coaxial lines of the most practical forms are calculated by means of conformal transformation. Good approximations to the impedance functions are obtained.

621.372.826

274 INVESTIGATIONS ON SURFACE WAVE TRANSMISSION LINES. T.Berceli.
Acta tech. Hungar, Vol. 25, No. 3-4, 257-76 (1959).

Results of attenuation measurements on single-wire transmission lines are given and discussed in some detail. Measurements were carried out in the band 2.0-3.7 kMc/s using a number of different launching horns. The lines investigated were some 50 mm long and the guides were made of the following materials: enamelled and bare copper wires, polythene and p.v.c. coated as well as stranded copper wire. The measured attenuations are stated to be some 30 to 40% higher than expected from theory. Some measurements on launching efficiency of various horns and radial field distribution are also recorded. A.E.Karbowiak

621.372.826 : 621.396.677.71

275 ANNULAR-SLOT LAUNCHERS FOR SINGLE-CONDUCTOR TRANSMISSION LINES.
J.Brown and H.S.Stachera.
Proc. Instn Elect. Engrs, Paper 2836R [Convention on Long-Distance Transmission by Waveguide], publ. Jan., 1959 (Part B Suppl. No. 13, 143-4, 145-50).

Republication, with discussion, of the paper abstracted in Abstr. 913 (1959).

621.372.829

276 GENERALIZED TELEGRAPHIST'S EQUATION FOR WAVEGUIDES OF VARYING CROSS-SECTION. G.Reiter.
Proc. Instn Elect. Engrs, Paper 3028 E [Convention on Long-Distance Transmission by Waveguide] publ. 1959 (Part B Supp. No. 13, 54-6).

Waveguides of varying cross-section are considered. An infinite system of ordinary differential equations is derived from the Maxwell equations and boundary conditions. The system of ordinary differential equations is converted into an infinite system of integral equations. The resulting formulae are particularly suitable for iteration.

621.372.829

277 THE INFLUENCE OF HELIX WIRE DIAMETER ON THE MODES IN A HELIX WAVEGUIDE. G. Piefke.
Proc. Instn Elect. Engrs, Paper 2858R [Convention on Long-Distance Transmission by Waveguides], publ. 1959 (Part B suppl. No. 13, 110-18).

The properties of waveguide modes (phase velocity greater than velocity of light) are investigated for a helix line of finite wire diameter and with an arbitrary surrounding medium. It is assumed that the guide wavelength is always much greater than the pitch of the helix. Use of the helix waveguide as a mode filter in transmitting the H_{01} mode is studied in particular. It is shown that the magnitude of the losses and the angle of pitch of the helix determine whether the waveguide modes are capable of existence. For a given angle of pitch the losses must be larger than a definite value to make waveguide modes possible. If the losses are less than this value, the helix line has only the character of a delay line (phase velocity smaller than velocity of light). On helix lines with an angle of pitch $\psi \ll 0.1$ the copper losses in the helix wire alone are sufficient to allow the existence of the H_{on} modes. For the H_{mn} modes, which interfere with H_{01} mode transmission, a maximum attainable loss exists which can be achieved by correct selection of the wire diameter in conjunction with the surrounding medium. This maximum loss is inversely proportional to the square of the helix diameter and to the frequency. For instance, with a helix diameter of 5 cm and a frequency of 50 Gc/s the maximum attenuation of the

H_{11} mode is $\alpha = 0.158$ nepers/cm, and hence exceeds by a factor of 3180 the attenuation in a homogeneous circular copper waveguide having the same dimensions.

621.372.829

278 HELIX WAVEGUIDE DESIGN. H.G.Unger.
Proc. Instn Elect. Engrs, Paper 2971E [Convention on Long-Distance Transmission by Waveguide], publ. 1959 (Part B Suppl. No. 13, 151-5).

A theoretical analysis of circular electric wave propagation in slightly curved, and slightly non-circular and non-uniform helix waveguide is the basis for design considerations. A radial wave impedance at the helix interface is used to calculate the effect of composite jacket structures. Three different applications of the helix waveguide for circular electric wave transmission are discussed. As a mode filter the helix waveguide should have a lossy jacket which causes a high transmission loss for all unwanted modes. For sharp intentional bends with tapered curvature the helix waveguide should have a jacket of low-loss dielectric material surrounded by a highly conducting coaxial shield. For an all-helix waveguide, in order to reduce both mode conversion-reconversion effects at imperfections and loss in curvature, the jacket should be medium lossy and also surrounded by a metallic shield. The distance between helix and shield should, in all applications, be about a quarter of the radial wavelength in the material. Measurements have been made on unwanted mode transmission in mode filters, TE_{01} loss in intentional bends of low-loss shielded helix waveguide and TE_{01} loss in bends of lossy shielded helix waveguide. Intentional bends of a 2 in-internal-diameter low-loss helix waveguide increase the TE_{01} loss at 55 Gc/s by about 0.001 dB per degree change in direction. In a lossy helix waveguide of 2 in internal diameter a radius of curvature of about 300 ft doubles the TE_{01} loss at 55 Gc/s.

621.372.829

279 THE CHARACTERISTIC IMPEDANCE AND PHASE VELOCITY OF A SHIELDED HELICAL TRANSMISSION LINE. H.S.Kirschbaum.
Trans. Amer. Inst. Elect. Engrs I, Vol. 78, 444-50 (1959) = Commun. and Electronics, No. 44 (Sept., 1959).

Presents the results of a theoretical and experimental investigation of the properties of a shielded helix when used as a transmission line. Since such a structure is dispersive and because of the presence of both TM and TE modes it cannot be said to have a characteristic impedance in the true sense. However, such an impedance is defined for low frequencies in terms of a distributed capacitance and inductance. These parameters, capacitance and inductance, are determined in the case of infinite wavelength for round wire helices. The equations are developed for a uniform dielectric inside the shield and for two dielectrics, one inside the helix and the other between the helix and the shield. The analytic results are then shown to agree very well with experimental results.

621.372.83 : 621.317.34

THE MEASUREMENT OF SPURIOUS MODES IN OVER-MODED WAVEGUIDES. See Abstr. 166

621.372.832

280 RESONANT RING DIPLEXING IN FORWARD SCATTER SYSTEMS. T.H.Moriarty.
Electronics, Vol. 32, No. 27, 54-6 (July 3, 1959).

In forward scatter systems the size of the aerial required makes the use of a single aerial for both transmission and reception a necessity. Because of the large difference in level between the outgoing and incoming signals a high degree of isolation between transmitter and receiver is needed. A duplexing system comprising a resonant ring and directional couplers is described which when made to resonate at some point within the transmitter band provides 60 dB isolation between transmitter and receiver, at X-band. Performance data and constructional details of similar devices at S-band are included. G.D.Sims

621.372.832.43

281 SOME PROPERTIES OF TRAVELLING-WAVE RESONANCE. J.R.G.Twisleton.
Proc. Instn Elect. Engrs, Paper 3031E, publ. Oct., 1959, 11 pp. To be republished in Vol. 107B (1960).

Gives a description of travelling-wave resonance in a waveguide ring fed through a directional coupler, and a resonance theory is developed which describes the behaviour of waves in the ring and the reflection and transmission in the feeder in the neighbourhood of resonance. The theory allows for equal propagation coefficients for the ring waves, or for a different propagation coefficient for one of the waves, and for a reflecting discontinuity in the ring. A method of investigating the ring resonance is described using a travelling probe, and experimental results are given for the case of equal ring-wave propagation coefficients, which substantiate the theory.

621.372.832.43

282 AN IMAGE LINE COUPLER. D.J.Angelakos.
I.R.E. Trans Microwave Theory and Tech., Vol. MTT-7, No. 3, 391-2 (July, 1959).

A coupler, which consists of a grounded metallic plane and two semicircular dielectric rods placed on opposite sides of the plane, is investigated. The coupling element is a small circular hole in the ground plane and the structure is effectively an adaptation of the Bethe hole coupler. Experimental results which are in good agreement with theory are given in graphical form. A.E.Karbowiak

621.372.832.8

283 LOW-LOSS S- AND L-BAND CIRCULATORS. F.Arams, G.Krayer and S.Okwit.
I.R.E. Nat. Convention Record, Vol. 7, Pt 3, 126-33 (1959).

Four-port S- and L-band circulators using magnesium-manganese-aluminate ferrite are described. The S-band circulator has an insertion loss in the region of 0.1 dB and an isolation greater than 24 dB, while the L-band device has an insertion loss of 0.3 dB and an isolation of 30 dB. The v.s.w.r. is 1.1 in each case. An L-band circulator using strip line with an isolation of 22 dB and an insertion loss of 0.3 dB is also described. R.C.Glass

621.372.834

284 FEEDING R.F. POWER FROM A SELF-EXCITED, PULSED SOURCE INTO A HIGH-Q RESONANT LOAD. H.A.Spuhler, R.J.Kenyon and P.D.Colman.
I.R.E. Trans Microwave Theory and Tech., Vol. MTT-7, No. 3, 391 (July, 1959).

Description is given of performance results on stabilization of a megawatt magnetron feeding a high-Q cavity. It is shown that isolator stabilization is superior to stabilization using a resistive load in a series tee. A 1.3 MW magnetron operating around 2.8 kMc/s and feeding a cavity (unloaded Q = 14 400) with 3 μsec pulses of p.r.f. of 60 c/s was investigated. An increase in cavity power of almost 38% is claimed in the case of isolator stabilization over the series tee structure. A.E.Karbowiak

621.372.85

285 NEW ISOLATORS FOR DIRECTIONAL TRANSMISSION SYSTEMS. J.Deutsch, W.Haken and C.v.Haza-Radlitz.
Nachrichtentech. Z. (N.T.Z.), Vol. 12, No. 7, 367-70 (July, 1959). In German.

Three new types of ferrite isolators centred at 4, 6 and 7 kMc/s for f.m. radio links are described. The 4 kMc/s element has an isolation >26 dB and an insertion loss < 0.3 dB over a 10% band, the isolation increasing with temperature at the design centre. The 6 kMc/s element has an isolation > 30 dB, varying slightly with temperature, and an insertion loss < 0.2 dB over an 8% band. Since the resonance absorption in a ferrite increases with frequency, the 7 kMc/s band is covered by three 300 Mc/s wide elements each having an isolation >50 dB and an insertion loss < 0.4 dB. Constructional details and performance graphs are included. Z.F.Voyner

621.372.852.1

286 THE DESIGN OF BAND-PASS FILTERS IN WAVEGUIDES. S.S.Forte.
Marconi Rev., Vol. 22, 99-116 (2nd Qtr, 1959).

Waveguide filters are an essential element in many applications and in particular in wide-band microwave links. The requirements are rather stringent in this instance, for the filters must have a passband of ± 12 Mc/s while at the same time they must have a rejection of 30 to 40 dB at off-band frequencies of ± 29 Mc/s, this being the C.C.I.R. recommended channel separation. The "maximally flat" type of filter is capable of achieving this performance, but necessitates a rather large number of resonant cavities (7 to 8). A different type of design is therefore considered which will satisfy the specification with a minimum number of cavities. A theoretical analysis is given for the maximally flat case, starting from the low-pass, lumped element prototype, leading eventually to the classical results obtained by Mumford (Abstr. 2543 of 1949). This form of analysis is then applied to the Chebyshev equal ripple-response case, and relations are given for a complete design of such filters. The practical realization of the resulting network, be it a maximally flat or a Chebyshev filter, is described.

621.372.852.1

287 A WAVEGUIDE SWITCHING SYSTEM FOR RADIO LINK EQUIPMENT. B.Standal.
Tekn. Ukeblad, Vol. 106, No, 29, 619-24 (Aug. 13, 1959).
In Norwegian.

Microwave radio links require small transmitter powers, hence large and relatively costly aerials are needed. It is desirable therefore to use the same aerial for different r.f. channels. For this purpose, the waveguide switching system described is used. It combines or separates 6 different r.f. channels in the 4000 Mc/s band. Each unit consists of short-slot and max. flat amplitude band-pass filters. Measurements of attenuation characteristics of the filters and voltage standing-wave ratios in the pass-band are shown and compared with theoretical values. G.N.J.Beck

621.372.852.22

288 TRANSVERSE ELECTRIC FIELD DISTRIBUTIONS IN FERRITE LOADED WAVEGUIDES. D.J.Angelakos.
I.R.E. Trans Microwave Theory and Tech., Vol. MTT-7, No. 3, 390-1 (July, 1959).

To aid in the design of field-displacement isolators, measurements have been made on field distribution in a waveguide partially filled with ferrite. The results are given in graphical form.
A.E.Karbowiak

621.372.852.223

289 A METHOD FOR ENHANCING THE PERFORMANCE OF NONRECIPROCAL MICROWAVE DEVICES.
B.Ancker-Johnson.
I.R.E. Trans. Microwave Theory and Tech., Vol. MTT-7, No. 3, 394-5 (July, 1959).

By designing ferrite devices for operation at the highest temperature likely to be encountered and controlling the ferrite temperature at this level, their operating characteristics can be kept constant. Methods of achieving this in practice are described.
R.C.Glass

621.372.852.5

290 A METHOD OF CHANGING THE DOMINANT MODE IN A HOLLOW METAL WAVEGUIDE AND ITS APPLICATION TO BENDS. H.E.M.Barlow.
Proc. Instn Elect. Engrs, Paper 2842R [Convention on Long-Distance Transmission by Waveguide], publ. Jan., 1959 (Part B Suppl. No. 13, 100-5, 145-50).

Republication, with discussion, of the paper abstracted in Abstr. 1601 (1959).

621.372.852.5

291 STEP TRANSDUCER BETWEEN OVER-MODED CIRCULAR WAVEGUIDES. L.Solymar.
Proc. Instn Elect. Engrs, Paper 2922 [Convention on Long-Distance Transmission by Waveguide] publ. 1959 (Part B suppl. No. 13, 129-31).

The amplitudes of the spurious modes due to a small step in an over-moded circular waveguide are computed, assuming that one of the waveguides is fed by a pure H_{01} mode. It is shown that the amplitude of the H_{02} mode is the largest of the spurious modes. For the reduction of the conversion losses, a simple transducer is designed. Its radius is the geometrical mean of the radii of the two waveguides to be connected. Its length is one-half beat-wavelength of the H_{01} and H_{02} modes.

621.372.852.5

292 CENTRE-EXCITED TYPE OF RECTANGULAR TE_{10} TO CIRCULAR TE_{01} MODE TRANSDUCER.
B.Oguchi and K.Yamaguchi.
Proc. Instn Elect. Engrs, Paper 2829R [Convention on Long-Distance Transmission by Waveguide], publ. Jan., 1959 (Part B Suppl. No. 13, 132-7, 145-50).

Republication, with discussion, of the paper abstracted in Abstr. 1599 (1959).

621.372.852.5

293 CHANNEL INSERTION FEED.
Y.Klinger and L.Lewis.
Proc. Instn Elect. Engrs, Paper 2840R [Convention on Long-Distance Transmission by Waveguide], publ. Jan., 1959 (Part B Suppl. No. 13, 138-42, 145-50).

Republication, with discussion, of the paper abstracted in Abstr. 1600 (1959).

621.372.852.5

294 DESIGN OF A TWO-SECTION CONICAL TAPER IN CIRCULAR WAVEGUIDE SYSTEM SUPPORTING THE H_{01} MODE. L.Solymar.
Proc. Instn Elect. Engrs, Paper 2833R [Convention of Long-Distance Transmission by Waveguide] publ. 1959 (Part B Suppl. No. 13, 119-20).

It is shown that a properly designed 2-section conical taper gives superior performance to a simple linear taper and that such a taper, of minimum length and fulfilling given mode conversion and bandwidth requirements, can be designed with the aid of the graphs and table given.

621.372.853

295 THE ATTENUATION AND PROPAGATION FACTOR OF SPACED-DISC CIRCULAR WAVEGUIDE. A.W.Gent.
Proc. Instn Elect. Engrs, Paper 2830 R [Convention on Long-Distance Transmission by Waveguide] publ. Jan., 1959 (Part B Suppl. No. 13, 37-46, 57-61).

Republication, with discussion, of the paper abstracted in Abstr. 1602 (1959).

OSCILLATORS . PULSE GENERATORS

621.373.4

296 FREQUENCY-JUMPS AND "PULLING" EFFECTS IN COUPLED CIRCUITS. W.S.Ehrenberg.
Bull. Assoc. Suisse Elect., Vol. 50, No. 21, 1009-16 (Oct. 10, 1959).
In German.

Admittance equations are derived for a pair of coupled oscillatory circuits and hence the oscillation frequency is determined, assuming the active element to be a constant pure negative resistance. The "pulling" effect is studied in terms of Q and coupling factor as parameters. V.G.Welsby

621.373.421.13

297 THE PERFECTION OF HIGH-FREQUENCY QUARTZ OSCILLATORS. P.Vovelle.
Onde elect., Vol. 39, 385-91 (May, 1959). In French.

Reviews the factors which govern the stability of quartz oscillators. Various types of oscillator and thermostat are considered.
R.C.Glass

621.373.432

298 GAS TUBES AS MUSIC GENERATORS.
A.Douglas.
Electronic Engng, Vol. 31, 672-3 (Nov., 1959).

621.373.44

299 ON THE APPROXIMATE ANALYSIS OF BISTABLE CIRCUITS USING JUNCTION TRANSISTORS. CASE OF COMMON EMITTER RESISTANCE CIRCUIT. C.Mira.
C.R. Acad. Sci. (Paris), Vol. 249, No. 3, 384-6 (July 20, 1959).
In French.

(See Abstr. 6536 of 1959). In this analysis the voltage generator previously considered is replaced by a resistance common to the two emitters and relations between the circuit parameters are obtained. These relations, in conjunction with specific operating data, enable the dynamic characteristics to be derived.
C.A.Hogarth

621.373.44

300 DYNAMIC TESTING OF COMPUTER BUILDING BLOCKS. R.W.Buchanan and B.Kautz.
Electronics, Vol. 32, No. 33, 66-8 (Aug. 14, 1959).

A gated pulse generator usable up to 18 Mc/s is described; it generates, at each of four cathode-follower outputs, positive pulses whose amplitude is continuously variable from 0 to 20 V. A gating system in each channel gives up to a 10 μsec burst or gap in a string of pulses. At 10 Mc/s the rise time is 7 mμsec and the decay time between 10 and 12 mμsec at no load. A complete circuit diagram with component values is given. G.A.Montgomerie

621.373.44

301 CARDIAC PACING — STIMULATION BY VERY PORTABLE EQUIPMENT. D.G.Kilpatrick and S.Bellet.
I.R.E. Nat. Convention Record, Vol. 7, Pt 9, 56-63 (1959).

A transistorized pace-maker is described which can be carried with ease for emergency use. The optimum pulse width is found to

be 3.5 msec and a cannula type electrode for insertion into the myocardium is employed, so avoiding the need for thoracotomy. The depth and position of the cannula are indicated by observation of the e.c.g. pattern shown on a miniature milliammeter. When correctly placed the stimulus is provided in the form of a constant current pulse, independent of impedance of the myocardium at the site of insertion. F.T.Farmer

621.373.443

302 FREQUENCY CONTROL OF MAGNETIC MULTIVIBRATORS. W.A.Geyger.
Electronics, Vol. 32, No. 30, 54-6 (July 24, 1959).

The frequency of a magnetically coupled transistor multivibrator is proportional to the d.c. input voltage. Frequency control without variation of the input voltage may be obtained by loading the output with a tapped saturable reactor. Continuous control may be effected by the use of variable transformers. Circuits are given for simple frequency control and for independent control of frequency and output voltage. The variable transformers may be used as shaft-position transducers for telemetering. W.G.Stripp

621.373.5

303 THE DESIGN OF TRANSISTOR PUSH-PULL D.C. CONVERTORS.
W.L.Stephenson, L.P.Morgan and T.H.Brown.
Electronic Engng, Vol. 31, 585-9 (Oct., 1959).

There are many methods by which d.c. may be converted from low to high voltage using some oscillating device, but one of the most efficient methods uses a transistor square wave oscillator controlled by a saturating transformer. For such a system design formulae are derived in terms of operating parameters. Most of the practical limitations and difficulties are outlined, but are not discussed in detail as individual solutions are usually required.

621.373.51

304 SOLID-STATE GENERATOR FOR MICROWAVE POWER. M.M.Fortini and J.Vilms.
Electronics, Vol. 32, No. 36, 42-3 (Sept. 4, 1959).

A transistor oscillator and amplifier supply 250 Mc/s power to a semiconductor diode (S-555G or Philco experimental), operated in the capacitive mode for 8th harmonic generation. Powers of 10 mW at 2000 Mc/s are extracted at total efficiencies up to 3.3%. A.Sczaniecki

621.373.524.1

305 AN ANALYSIS OF A TRANSISTORIZED CLASS "B" VERTICAL DEFLECTION SYSTEM.
Z.Wiencek and J.E.Bridges.
I.R.E. Nat. Convention Record, Vol. 7, Pt 7, 59-69 (1959).

After a brief analysis of various modes of transistor-operated frame time-bases, indicating the desirability of class "B" push-pull operation because of its much higher efficiency, a practical circuit is suggested and discussed in detail. Various ways of shortening retrace time (the main problem) are considered, the method adopted using a bypassed diode between the two transistors. During forward scan it conducts and can be regarded as a constituent of upper transistor's emitter resistance; during flyback, when the lower transistor is turned off, the voltage across the yoke swings towards the rail and disables the diode. A resonant path is formed, including the upper transistor, and the resulting half-cycle oscillation speeds up the flyback time. A full circuit diagram and numerous waveforms of the blocking oscillator, driver and output stages are reproduced; linearization and control methods and stability performance are also treated. A.Landman

621.373.53

306 TRANSISTORS AND SATURABLE-CORE TRANSFORMERS AS SQUARE WAVE OSCILLATORS. G.C.Fleming.
Electronic Engng, Vol. 31, 543-5 (Sept., 1959).

The use of transistors as switches for the d.c. supply to saturable core transformers is described and it is shown that by this means small and efficient convertors and inverters can be constructed. The common base, common emitter and common collector configurations are considered and methods of obtaining a multi-phase output are described.

621.373.54

307 A TRANSISTOR STIMULATOR FOR PHYSIOLOGICAL USE. R.E.George.
Electronic Engng, Vol. 31, 530-3 (Sept., 1959).

A stimulator is described for measurement of the refractory period which follows excitation in a nerve. It produces pairs of rectangular pulses separated by an adjustable time interval. The duration of both pulses can be varied independently. The maximum amplitude available is 20V from an impedance not exceeding 2kΩ. The pulse durations are variable in steps from 30μsec to 30msec. The sequence repetition rate may be varied from once in 3sec to 330 times/sec.

PULSE CIRCUITS . DIGITAL CIRCUITS SWITCHING CIRCUITS

621.374.3 : 621.376.53

308 AN INVESTIGATION INTO SOME ASPECTS OF DIODE QUANTIZING CIRCUITS. H.V.Bell and W.Alexander.
Electronic Engng, Vol. 31, 594-8 (Oct., 1959).

Quantization is defined and some past work on diode quantizers is reviewed. Three circuits are compared both theoretically and by measurement, and the results presented. A possible application of these circuits is then described.

621.374.3 : 621.382.23

309 APPROXIMATE WAVEFORM SOLUTIONS FOR DIODES IN PULSE CIRCUITS. D.C.Dillistone.
Electronic Engng, Vol. 31, 607-10 (Oct., 1959).

Taking an approximate representation of a diode, waveform solutions are obtained for a group of simple circuits to which a rectangular, or (in one case) a triangular waveform is applied. Certain applications of the results are discussed in general terms.

621.374.32

310 THE APPLICATION OF TRANSISTORS TO NUCLEONIC INSTRUMENTATION. A.G.Klein and A.W.Pryor.
Proc. Instn Radio Engrs Australia, Vol. 20, No. 7, 388-405 (July, 1959).

The design and performance of transistor nucleonic circuits are discussed under the following headings: (a) e.h.t. supplies, (b) amplifiers (input stage and noise), (c) amplitude discriminators, (d) scalers, including the use of dekatrons, (e) ratemeters, and (f) d.c. amplifiers. 48 references are included.

621.374.32

311 A DIRECT READ-OUT BISTABLE CIRCUIT AND SOME APPLICATIONS OF IT. H.R.De Miranda and I.Rudich.
Western Joint Computer Conference (see Abstr. 4755 of 1959). p. 134-8

The circuit comprises a transistor in conjunction with a subminiature vacuum triode with a fluorescent anode thus incorporating indication of state. The circuit is fully analysed and variations described. Its advantages are: less than 30μW triggering power, high output power and simplicity of circuit. G.H.Stearman

621.374.32

312 A TRANSISTOR SCALING CIRCUIT WITH A SHORT RESOLVING TIME. B.Collinge.
Electronic Engng, Vol.31, 604-5 (Oct., 1959).

The advantages are discussed of coupling one scale-of-two circuit to another by means of a gate circuit. A circuit diagram and a description are given of a complete unit consisting of a gate circuit and a bistable circuit.

621.374.32

313 A SIGN AND MAGNITUDE DISPLAY FOR USE WITH REVERSIBLE COUNTERS. D.L.A.Barber.
Electronic Engng, Vol.31, 605-6 (Oct., 1959).

A circuit is described which may be used with any reversible counter to provide a display of the sign and magnitude of numbers.

621.374.32

314 HOW TRANSISTOR DRIVES COLD-CATHODE COUNTER. H.Sadowski and M.E.Cassidy.
Electronics, Vol. 32, No. 38, 46-7 (Sept. 18, 1959).

Operation of Dekatron counter tubes and drive waveform criteria for successful operation are discussed. A transistor blocking-oscillator which provides the two staggered drive pulses from a single trigger pulse 100 μsec wide is then described. A.Reiss

621.374.32

315 INCREASING COUNTING SYSTEM RELIABILITY. H.A.Kampf.
Electronics, Vol. 32, No. 37, 112-13 (Sept. 11, 1959).

Two transistor-coupled Dekatron counter circuits are described. One utilizes the 4 kc/s maximum rate of counting of the Dekatrons, while the other is usuable only up to 1 kc/s. Both are claimed to be reliable. T.H.D.Attewell

621.374.32

316 BINARY CIRCUITS COUNT BACKWARDS OR FORWARDS. H.J.Weber.
Electronics, Vol. 32, No. 39, 82-3 (Sept. 25, 1959).

A reversible binary counter, assembled on small digital building blocks, is described. Control logic as well as the actual working circuits are discussed. A.Reiss

621.374.32

317 A DIGITAL REMOTE POSITION CONTROL. K.G.Hilton.
Electronic Engng, Vol. 31, 512-19 (Sept., 1959).

Describes an investigation into the problems involved in constructing a digital remote position control. Shaft position is measured digitally and the servomotor control circuits operate digitally. The logical arrangements of the circuits and methods of stabilizing a digital remote position control are discussed. A coarse system is described which is accurate only to 45° since this was considered to be sufficient to show the system principles and the design problems.

621.374.32 : 621.318.57

318 ABSOLUTE MINIMAL EXPRESSIONS OF BOOLEAN FUNCTIONS. S.Abhyankar.
I.R.E. Trans Electronic Comput., Vol. EC-8, No. 1, 3-8 (March, 1959).

Absolute minimal expressions are found for those Boolean functions whose point set complex consists of either one or two points; for previous work and basic notation see Abstr. 2824 (1959). In the case of one point, g is of the type "product" and g = f. The case where two points form a 1-cell is covered by a theorem applying to an m-cell in which g is of the form "product" and

$$g = x_{i_1} \ldots\ldots x_{i_g}\, x_{j_1}' \ldots\ldots x_{j_t}'$$

In the case where the cell complex consists of two isolated points the situation is more complicated, but a method is established by which all the absolute minimal expressions equivalent to f can be derived. G.A.Montgomerie

621.374.32 : 681.142

319 TRANSISTORIZED SWITCHING CIRCUITS IN DATA PROCESSING SYSTEMS. K.Gosslau and K.Braun.
Elektron. Rechenanlagen, Vol. 1, No. 1, (1959). [Reprinted in: Entwicklungsber. Siemens and Halske, Vol. 22, No. 2, 159-67 (Aug., 1959)]. In German.

Various systems of circuit logic which differ as to the mode of operation of the transistors (saturated or non-saturated, d.c.-coupled or a.c.-coupled) and also in the components employed for the realization of logic functions, are compared. The RCT-(resistor-capacitor-transistor-) logic has advantages in terms of switching speed, switching equipment cost, and simplicity of circuit elements. RCT-circuits perform (in analogy with relay circuits) logical operations through series and parallel connections of saturated, d.c.-coupled transistors, the latter providing for additional amplification. Diode-gated flip-flop circuits serve as delay or storage elements. Examples explaining both the combination and interoperation of circuit elements are given. 43 references, mainly to U.S. literature.

621.374.32 : 621.318.57 : 681.142

320 SWITCHING CIRCUITS USING BI-DIRECTIONAL NON-LINEAR IMPEDANCES. T.B.Tomlinson.
J. Brit. Instn Radio Engrs, Vol. 19, No. 9, 571-91 (Sept., 1959).

In a brief general review of logic circuitry, a case is developed for a bi-directional, non-linear switching element. In order to compare circuits using such elements with those using standard semiconductor diodes, the main features of diode gates are considered in detail. Particular attention is paid to design of p-n-p transistor driver stages and their dependence on the logic sequence. Circuits using a bidirectional "constant voltage" element are described, using a "two-decision" AND gate. Possible types of constant voltage element are discussed and experimental results are given for multi-electrode silicon carbide devices. An interesting feature of the latter is the non-linear behaviour of capacitance. An attempt is made to compare gating circuits employing constant voltage, bi-directional elements with standard diode gates from a performance/cost point of view. A "majority-logic" gate is made possible by a "constant current", bidirectional element. If one input is used as a control, this gate can become a many function gate, thus a 3-input gate can be controlled to act as a 3-AND, an OR, or a "2 or more out of 3" logical unit without change of input or output connections. Some possible realizations of the constant current device are discussed. A binary-octal decoder circuit and a simple binary full adder circuit are given as examples of the application of the non-linear elements and to illustrate their unusual features.

621.374.32 : 621.318.57 : 621.387

321 ACCESS [AUSTIN COLD-CATHODE ELECTRONIC SWITCHING SYSTEM]. A STATIC SWITCHING SYSTEM USING COLD-CATHODE TUBES. R.W.Brierley.
Electronic Engng, Vol. 31, 646-54 (Nov., 1959).

Describes the application of a cold-cathode tube switching system to the control logic of a multi-station transfer machine; the actual sequencing and power switching are performed by a uni-selector and relays. The system has advantages over a wholly electromechanical system of increased reliability and speed of maintenance, the tubes being self-indicating.

A.O.Stanesby

621.374.32 : 621.318.57

322 MAGNETIC SWITCHING. J.A.Rajchman.
Western Joint Computer Conference (see Abstr. 4755 of 1959). p. 107-16.

A survey of the application of square hysteresis loop magnetic materials to computer storage and addressing and shift registers. Special emphasis is laid upon the various forms of the transfluxor and its applications. G.H.Stearman

621.374.32 : 621.318.57

323 SUPERCONDUCTIVE DEVICES. A.E.Slade and H.McMahon.
Western Joint Computer Conference (see Abstr. 4755 of 1959). p. 103-7.

The basic mechanisms of superconductivity, the critical current and the influence of surface magnetic fields are briefly explained. The cryotron storage element is introduced and its current gain defined. The inherent inductance of the cryotron gives it a high time-constant which is difficult to reduce although several techniques are listed. The principles of a number of cryotron circuit applications are discussed. Vacuum-deposited cryotrons offer higher speeds and simplified construction. The persistent-current circuit as a storage element has potentially even higher speed capabilities, times of less than 10 millimicrosecs having been reported. The methods of use are explained. G.H.Stearman

621.374.32 : 681.142

324 I.B.M. CURRENT MODE TRANSISTOR LOGICAL CIRCUITS. J.L.Walsh.
Western Joint Computer Conference (see Abstr. 4755 of 1959) p. 34-6.

These circuits employ differential configurations of drift transistors in the unsaturated region, a small voltage swing being able to switch a constant current from one transistor to the other. By this means the cut-off frequency and collector capacitance, being functions of collector voltage and current, are maintained near the optimum for high speed operation. Both p–n–p and n–p–n circuits are used alternately to allow direct coupling and reduce propagation delays. The usual logical and storage circuits are described as well as a special low-delay "exclusive — or" circuit, and the effect of noise sources upon stability is discussed. Typical circuit delays using transistors of cut-off frequency 70-150 Mc/s are from 6.0 to 22 mμs. G.H.Stearman

621.374.32

325 THE FLOW DIAGRAM APPROACH TO COMPUTER LOGICAL DESIGN USING THE NCR 304 AS AN ILLUSTRATION. J.Hudson, W.Edwards and D.E.Eckdahl.
Western Joint Computer Conference (see Abstr. 4755 of 1959) p. 59-62.

The detailed logical design of a computer may be approached in a manner similar to that employed by programme writers who first lay out a flow diagram which denotes the desired sequence of computer commands. In this case, however, the flow diagram comprises the detailed operations of the computer. Just as a programme writer may design a flow using only a general knowledge

of the computer's capabilities, so may the logical designer lay out a flow diagram for each order having in mind only the general character of the functional units of the machine he is designing. Upon completion of the flow diagrams for all orders in the list he can specify in detail the interconnections required. Application to the NCR 304 computer is explained in detail. G.H.Stearman

621.374.32

326 MINIMUM TRANSISTOR LOGIC MODULES FOR AIRBORNE CONTROL APPLICATIONS. A.Landy, Jr.
Western Joint Computer Conference (see Abstr. 4755 of 1959), p. 141-4.

Simple and economical circuit design is a feature of a set of logic and bistable packages intended specifically for air-borne digital systems. Flexibility of interconnection is achieved by high input and low output impedances. Medium-speed and fast circuits are available for bit-rates of 400 kc/s and 5 Mc/s respectively. A 20-bit shift register using the fast circuits occupies 7 cubic inches. G.H.Stearman

621.374.32

327 MILLIMICROSECOND DIGITAL COMPUTER LOGIC. N.F.Moody and R.G.Harrison.
Electronic Engng, Vol. 31, 526-9 (Sept., 1959).

A system of fast pulse logic is described which combines the efficiency of transformer coupled stages with digit delay tolerances approaching that of d.c. coupled systems. Logical circuits for "or", "and", "invertor" and "reclock" are shown, together with a driver which permits a "fan out" factor of 5. Transistor circuits are used throughout.

621.374.32

328 SOME ASPECTS OF THE LOGICAL AND CIRCUIT DESIGN OF A DIGITAL FIELD COMPUTER.
I.F Brown and B.Meltzer.
Electronic Engng, Vol. 31, 590-2 (Oct., 1959).

The principles of a new type of digital computer for the solution of field problems are described. By making the calculation at all the lattice points of the field simulataneous, this computer shortens computation time very greatly. A unitary (abacus) rather than binary or decimal arithmetic is used. The computation is done by lattice units, one associated with each lattice point of the field. The synthesis of lattice units from simpler basic units is described. The experimental design of a basic unit suitable for potential and other problems is presented. Some of the many outstanding problems of this computer are briefly referred to.

621.374.32 : 621.376.223

THE USE OF SILICON DIODES IN D.C. MODULATORS AND THEIR APPLICATIONS TO DRIFT CORRECTORS FOR COMPUTING AMPLIFIERS. See Abstr. 359

621.374.33

329 TRANSISTOR-MAGNETIC CORE BILOGICAL COMPUTER ELEMENT. W.J.Dunnet and A.G.Lemack.
Western Joint Computer Conference (see Abstr. 4755 of 1959). 144-9 pp.

Where previously described, transistor-core logical circuits have separated the functions of logic, regeneration and isolation; this design shares the logic between the core and transistor, resulting in fewer components. Other advantages achieved are versatility, low peak powers, speeds up to 1 Mc/s and the use of cores, transistors and resistors only. G.H.Stearman

621.374.33

330 FLOW GATING. W.J.Poppelbaum.
Western Joint Computer Conference (see Abstr. 4755 of 1959). p. 138-41.

The standard arrangement used to transfer information from one bistable circuit to another requires severing elements in the connection between them. The number of diodes and triodes in these "gates" is often comparable with that in the bistable itself. A scheme is described in which the transfer is effected by a simple diode between the two bistables together with a change in the supply voltage to one of them. The method appears attractive for small bistable memories. Inputs and outputs of a number of stages may be parallel-connected and information transferred between any two partially selected stages. G.H.Stearman

621.374.33 : 621.382.2

331 HIGH-SPEED CIRCUIT TECHNIQUES UTILIZING MINORITY CARRIER STORAGE TO ENHANCE TRANSIENT RESPONSE. L.P.Retzinger.
Western Joint Computer Conference (see Abstr. 4755 of 1959), 149-55 pp.

Describes techniques for bistable and logical circuits in which the carrier storage effect in a silicon diode is used to reduce the deleterious effect of the storage in a transistor base, thus improving transient response. An attempt is made to combine both slow and fast diodes with transistors in a manner which most effectively complements the fundamental characteristics of each semiconductor. G.H.Stearman

621.374.4

332 USING DIVIDER VERNIER TO SYNCHRONIZE PULSES. E.F.Wilson.
Electronics, Vol. 32, No. 27, 44-5 (July 3, 1959).

The division ratio of a series of counters may be increased by causing an output pulse to trigger a pulse generator which closes an inhibit gate and routes the input pulses to a store. The inhibit gate is re-opened after n input pulses and the number of input pulses required for an output pulse is increased by n. The division ratio is decreased by inserting n pulses between the regular input pulses. The method is applied to a 1000 : 1 divider to enable the output pulse to be synchronized with the 1 sec pulse from station WWV to set a standard clock. W.G.Stripp

621.374.4

333 MICROWAVE MIXER PERFORMANCE AT HIGHER INTERMEDIATE FREQUENCIES.
M.Colin and J.B.Newman.
I.R.E.Nat. Convention Record, Vol.7, Pt 3, 169-76 (1959).

Measurements were made of noise ratio and conversion loss of a number of crystals in order to determine the optimum intermediate frequency for a single-ended mixer for those frequency bands in which matched crystals are not available, and to investigate if sensitivity comparable with a balanced mixer can be obtained. The results show that by operating at higher intermediate frequencies performance comparable with balanced mixers can be obtained. Recommendations for optimum performance are given. R.C.Glass

621.374.42

334 A TRANSISTOR BLOCKING OSCILLATOR FREQUENCY DIVIDER. F.Butler.
Electronic Engng, Vol. 31, 611-12 (Oct., 1959).

The frequency divider includes a "staircase" waveform generator designed to produce a multiple step waveform in which all the voltage increments are equal in amplitude. After a prescribed number of steps, the output is used to trigger a blocking oscillator which gives a recurrent pulse output at a fixed sub-multiple of the input step frequency. The frequency divider operates from a source giving a sinusoidal output waveform which is squared and limited in order to make the mode of operation independent of the amplitude of the input signal. An output amplifier follows the blocking oscillator. Transistors and diodes of readily available types are used throughout.

AMPLIFIERS

(Abstracts on magnetic amplifiers appear also under Inductors . Reactors)

621.375.123 : 621.317.79

335 A COMPENSATION TECHNIQUE FOR REDUCTION OF PERFORMANCE ERRORS OF OPERATIONAL AMPLIFIERS. K.P.P.Nambiar and A.R.Boothroyd.
Proc. Instn Elect. Engrs, Paper 3082 E [International Convention on Transistors and Associated Semiconductor Devices], publ. 1960, (Part B Suppl. No. 15, 496-504).

A simple compensation technique, previously employed for the improvement of the sweep linearity of bootstrap sweep generators, is investigated as a means of reducing the performance errors of operational amplifiers. It is shown that such compensation is capable of quite general application but is of most value in the case of transistor amplifier circuits, where the active element may be regarded as a current amplifier. Thus multiple-input transistor operational amplifiers may be improved by compensation, whereas in the valve amplifier case the technique is restricted to single-input cir-

cuits. Simple forms of compensating circuit are derived for summing, integrating and differentiating amplifiers; correction for the fall of gain of the active element at high frequencies is also included. The main results of the paper are illustrated by practical examples in which the active element is a single-emitter stage.

621.375.13

336 A DRIFT-FREE DIRECT-COUPLED AMPLIFIER UTILIZING A CLIPPER-RC FEEDBACK LOOP.

J.N.Van Scoyoc and E.S.Gordon.
I.R.E. Nat. Convention Record, Vol. 7, Pt 7, 47-54 (1959).

The feedback loop uses a low-pass RC circuit and includes a bipolar clipper. The d.c. component at the output is virtually zero and free from drift. The circuit thus has the advantages of an a.c. amplifier but does not require synchronized output detection, though input chopping may be used for special purposes. With a gain of 20 000 and a peak output of 100V the output drift does not exceed 50 mV over two weeks. Applications in a pulse-height analyser for aerosol particle counting and a 20-channel, switched input amplifier are illustrated. W.G.Stripp

621.375.2.029.4

337 DESIGNING A MULTI-PURPOSE STEREO PRE-AMPLIFIER.

J.Rodrigues de Miranda and H. v.d.Kerckhoff.
J. Audio Engng Soc., Vol. 7, No. 2, 75-80 (April, 1959).

The amplifier output is 0.6 V at high impedance when fed from either: (1) a tape deck (embodying its own pre-amplifier — 60 mV input); (2) a radio receiver (350 mV input); (3) a dynamic pick-up (5 mV at 1 kc/s input); or (4) a crystal pick-up (150 mV at 1 kc/s input). The pre-amplifier consists of a pentode and a double-triode, the pentode being used with a pick-up input only. A rumble filter is included in the feedback network of the double-triode. Full circuit details are provided. H.G.M.Spratt

621.375.221.2

338 A DISTRIBUTED AMPLIFIER FOR COINCIDENCE MEASUREMENTS IN NUCLEAR PHYSICS. W.Schneider.
Acta phys. Austriaca, Vol. 12, No. 4, 453-60 (1959). In German.

The amplifier has three stages with two valves each and a final stage of four valves. The Z_0 of the anode and grid delay lines are 355 Ω and 169 Ω respectively. Unmatched coupling from anode line to the grid line of the next stage is used, this arrangement giving a smaller loss of gain, while the anode and grid impedances fully exploit the E180F valves. A 50 mμsec rectangular pulse can be amplified over 300 times with a rise time of 4×10^{-9} sec. The design of the delay lines is analysed. W.G.Stripp

621.375.225

339 AMPLIFIERS FOR STRAIN GAUGES AND THERMO-COUPLES. R.S.Burwen.
Electronics, Vol. 32, No. 30, 43-5 (July 24, 1959).

Noise voltages produced by earthing at two different points in resistance strain gauge and thermocouple circuits have necessitated the development of amplifiers with high common-mode rejection, the apparatus being primarily developed for cases where the earth of the preamplifier may be several hundred feet from that of the transducer. The amplifier devised covers the range from d.c. to 25 kc/s and has a bridge-type transformer-coupled input circuit with both positive and negative feedback. The cancellation of input d.c. drift is achieved by chopper stabilizing and by feedback and the input impedance is arranged to be infinite when used with a balanced source. The noise voltages are rejected by a resistance bridge at the input which passes differential signals while balancing out the noise signals. A.C.Whiffin

621.375.3

340 HOW MAGNETIC AMPLIFIER CONTROLS TRANS-CONDUCTANCE. C.C.Whitehead.
Electronics, Vol. 32, No. 46, 84-7 (Nov. 13, 1959).
For abstract, see Abstr. 5982 (1959).

621.375.3

341 THE DESIGN OF MAGNETIC AMPLIFIERS WITH RECTIFIED OUTPUT INTO RESISTIVE–INDUCTIVE LOAD. A.G.Zdrok.
Elektrichestvo, 1959, No. 5, 25-31 (May). In Russian.

The basic assumptions made are that the voltage drop of the rectifying bridge at the instant of current commutation is zero and that under normal operation with germanium rectifiers the voltage drop across the bridge is negligible. An analysis is first carried out for a bridge fed through a linear inductance into an inductive load; this is repeated with a non-linear inductance (a magnetic amplifier as source). The treatment in the latter case is extended to cover the use of internal feedback. A feature of the analysis is the successful use of average quantities. S.C.Dunn

621.375.3

342 THE SELF-REGULATION OF DIESEL-DRIVEN GENERATORS USING MAGNETIC AMPLIFIERS.

O.A.Nekrasov and A.Ya.Shikhin.
Elektrichestvo, 1959, No. 5, 31-6 (May). In Russian.

In the design of diesel-electric drives, a decision has to be taken whether the excitation will be from d.c. or from a synchronous exciter. In both cases there are two factors to be taken into account: deviation in the generator and exciter characteristics; hysteresis and temperature effects. When a synchronous exciter is used, the second group of factors have a significantly smaller influence; however questions arise as to the stability of the control system used for such an exciter and this is the scope of the present paper. The general scheme is to provide the generator itself with inherent self-regulation and to supplement this with a separate control using a magnetic amplifier. Experimental results are reported on a 230 V, 274 A, 970 rev/min generator, type PN-750, driven from a 3-ph. motor. The agreement between theory and practice is considered satisfactory. S.C.Dunn

621.375.3

343 PROPOSED STANDARD TEST CODES FOR MAGNETIC AMPLIFIERS.

Trans. Amer. Inst. Elect. Engrs I, Vol. 78, 453-6 (1959) = Commun. and Electronics, No. 44 (Sept., 1959).

621.375.4

344 DESIGNING TRANSISTORIZED VIDEO AMPLIFIERS. II. R.G.Salaman.
Electronic Industr., Vol. 18, No. 7, 94-6 (July, 1959).

For Pt I see Abstr. 7355 of 1959. Briefly discusses the choice of load resistances and frequency-response compensating circuits desirable in "voltage-doubler" and "cascade push-pull" amplifiers to achieve the large voltage swing needed to drive the cathode-ray tube grid with acceptable distortion. F.F.Roberts

621.375.4

345 A NEW APPROACH TO LOW DISTORTION IN A TRANSISTOR POWER AMPLIFIER. H.J.Paz.
I.R.E. Nat. Convention Record, Vol. 7, Pt 7, 140-5 (1959). See also Electronics, Vol. 32, No. 37, 118-20 (Sept. 11, 1959).

Full design details are given. The output circuit is series connected and a complementary-symmetry circuit is used as a phase-splitter for the driver stages. Local feedback is used to control the individual phase-response of each stage and variations in input resistance during the working cycle are partly compensated for by shunt resistors across the input of the transistors. The amplifier gives $< 0.25\%$ distortion at 10 W output. Frequency response, when the output power is 1 W, is within ±2 dB from 20 c/s to 20 kc/s. J.MacCormack

621.375.4

346 AN EVALUATION OF TRANSISTOR LOWPASS BROAD-BANDING TECHNIQUES.

D.O.Pederson and R.S.Pepper.
I.R.E. WESCON Convention Record, Vol. 3, Pt 2, 111-26 (1959).

A typical amplifier stage is considered for each of the broad-banding techniques: shunt peaking, series peaking, resistive broad-banding, transformer coupling, local feedback and the c.c.–c.e. pair. Gain, bandwidth and gain–bandwidth product are evaluated. A simple design technique is presented for the shunt peaked stage, which is best. A.Sczaniecki

621.375.4

347 CALCULATIONS AND MEASUREMENTS FOR THE OPTIMUM DESIGN OF LOW-NOISE TRANSISTOR AMPLIFIERS. K.Spindler.
Nachrichtentech. Z. (N.T.Z.), Vol. 12, No. 5, 250-6 (May, 1959). In German.

Concerned with the part of the noise which is independent of frequency. Calculations and measurements of this type of noise have been expressed in terms of the source impedance R_g and the emitter current I_e with the object of finding the relationship between these two parameters for optimum signal/noise ratio. The results are expressed in the form of a nomogram. V.G.Welsby

621.375.4

348 WIDE-BAND TRANSISTOR AMPLIFIERS. J.Dezoteux.
Onde elect., Vol. 39, 726-32 (Sept., 1959). In French.

Commencing with the hybrid-pi equivalent circuit for the transistor, expressions are obtained for the current gain and 3dB-down bandwidth of a common-emitter stage with resistive source and load, and also for a cascade of similar stages. Inductance and capacitance compensation are briefly mentioned for increasing the bandwidth, and some experimental results are given for a two-stage and a twin two-stage amplifier. F.F.Roberts

621.375.4 : 621-526

349 A TRANSISTOR QUADRATURE SUPPRESSOR FOR A.C. SERVO SYSTEMS. I.C.Hutcheon and D.N.Harrison.
Proc. Instn Elect. Engns, Paper 3134 M, publ. Jan. 1960 (Vol. 107 B, 73-82).

If the response angle of the demodulator in an a.c. servo system is not zero, any phase error in the input carrier signal causes an error in the servo output. Correcting the response angle to zero eliminates the output error, but is often impracticable and does not significantly reduce the residual signal at balance. This signal may saturate the amplifier, so making the servo insensitive or even completely inoperative. Both effects are eliminated if a quadrature signal of appropriate magnitude is fed to the amplifier input so as to suppress the residual signal. If the phase error and hence the residual signal are not stable, the suppression must be controlled automatically, e.g. by a resistive element whose gain is varied by the signal itself. A quadrature suppressor which uses four low-power transistors and three indirectly heated thermistors is described. Two of the transistors form a pre-amplifier, and two operate in switched mode as a demodulator, driving two of the thermistor heaters differentially. The corresponding thermistor beads act as a variable voltage divider which is used to control a suppression signal of precise quadrature phase. The transistors are all direct-coupled, and the third thermistor provides d.c. feedback around the suppressor giving thermal stability and constant output resistance characteristics in ambient temperatures between 0 and 60° C. The device is analogous to a servo-driven slide-wire of moderate linearity, and will operate with a loop gain of several hundred without instability.

621.375.4

350 TRANSISTOR O.T.L. [OUTPUT TRANSFORMERLESS AMPLIFIER] DELIVERS 8 WATTS. D.Meyer.
Radio-Electronics, Vol. 30, No. 10, 34-8 (Oct., 1959).

This amplifier was designed for the second channel of a stereo high-fidelity system. It consists of: (1) a phase invertor which is a transistor version of a long-tailed pair; (2) two push-pull voltage amplifier stages; (3) two emitter-follower stages; and (4) a bridge-type Class A output stage feeding directly into a 8 ohm loudspeaker giving an output power of 8 W. Circuit and constructional details are given, emphasis being laid on the necessity for generous heat sinks. Harmonic distortion is below 2% and the response is flat to within ±5 dB from 20 c/s to 20 kc/s. H.G.M.Spratt

621.375.43

351 LOCAL FEEDBACK IN TRANSISTOR AMPLIFIERS. H.Pfyffer.
Electronic Engng, Vol. 31, 550-5 (Sept., 1959).

Common-emitter amplifier stages are first discussed. The effects of negative feedback on gain, impedance and cut-off frequency are then calculated, and theoretical calculations are compared with measured results. Some of these comparisons are illustrated graphically.

621.375.5 : 537.311 : 539.2

352 "HOT" ELECTRON EXPERIMENTS IN InSb. APPLICATION TO THE REALIZATION OF AN OSCILLATOR. J.Bok and R.Veilex.
C.R. Acad. Sci. (Paris), Vol. 248, No. 16, 2300-2 (April 20, 1959). In French.

The conductivity and Hall effect were studied at high electric fields. In material which is only slightly p-type, the creation of hole–electron pairs by collision causes the Hall effect to change sign and this was observed experimentally at 77° K using a pulsed electric field (1 to 10 μsec). The current–voltage characteristic of a bar of such material in a longitudinal field of 1500 G shows a negative resistance region and this has been used with an LC circuit to generate oscillations. Sinusoidal oscillations were obtained in the range from 5 to 30 Mc/s and also at 1200 Mc/s. Besides this, oscillations arising from some other mechanism were observed at lower electric fields of the order 40 V/cm. W.Bardsley

621.375.9

353 TRANSMISSION LINE INVOLVING PARAMETRIC ELEMENTS; ESPECIALLY ON PERIODICALLY DISTRIBUTED PARAMETRIC AMPLIFIERS. S.Saito.
J. Inst. Elect. Commun. Engrs Japan, Vol. 42, No. 6, 573-9 (June, 1959). In Japanese.

The author considers that the more promising type of travelling-wave parametric amplifier is one in which variable-capacitance diodes, periodically loaded in the transmission line, are used as the active elements. Matrix analysis is applied to determine the general characteristics of this type of amplifier. The simplest example of such an amplifier consists of a lossless transmission line periodically loaded with variable capacitors whose invariant parts are effectively cancelled out. The capacitances of these parametric elements are assumed to be modulated by the pumping wave synchronized with the signal and the idling waves propagating in the same direction, the amplifier having unilateral gain in this direction. Formulae are derived for the four eigenvalues of the propagation constants, and the eigenvector belonging to each eigenvalue is given. In the limiting case the equations for this amplifier become the same as those for the uniform travelling-wave parametric amplifiers. Some idea of the noise figure of this kind of parametric amplifier is obtained by taking account of the loss factor of the parametric elements. See also Abstr. 3106 and 3107 of 1958. A.Wilkinson

621.375.9

354 AN ANALYSIS OF PERIODICALLY DISTRIBUTED PARAMETRIC AMPLIFIERS. K.Kurokawa and J.Hamasaki.
J. Inst. Elect. Commun. Engrs Japan, Vol. 42, No. 6, 579-85 (June, 1959). In Japanese.

A travelling-wave parametric amplifier with semiconductor diodes periodically loaded in a transmission line can be considered as a cascade connection of n networks, each including a diode. Because of the pumping phases concerned, the networks are different from one another, so that the solutions of the eigenvalue problem of the operator T representing the basic section (see previous abstract) are of no advantage. A new operator T_0 is introduced which is the product of an operator E^{-1}, representing the pumping phase relation, and the T matrix of the basic section. The orthogonal properties of the eigenvectors of T_0 are proved by use of one of the Manley–Rowe relations (see Abstr. 4480 of 1956). An arbitrary vector can be expressed as the sum of the eigenvectors, and each eigenvector is transformed into $\lambda_k^{n_1 n_2} A_k$ by the amplifier, where λ_k is the eigenvalue corresponding to A_k. These properties prove very useful in the analysis. As an example, the power gain of this type of parametric amplifier is calculated for the case of synchronous pumping. A.Wilkinson

621.375.9

355 LOW-NOISE MICROWAVE REACTANCE AMPLIFIERS WITH LARGE GAIN–BANDWIDTH PRODUCTS. P.P.Lombardo and E.W.Sard.
I.R.E. WESCON Convention Record, Vol. 3, Pt 1, 83-98 (1959).

A discussion of parametric amplifiers with terminal impedances possessing negative conductance components. A theory is presented which expresses the gain–bandwidth products for two types of amplifier in terms of non-linear capacitance and the circuit parameters. The theory enables amplifiers to be designed with nearly optimum noise figures. Amplifiers working in the region of a few Mc/s have been built which verify the gain–bandwidth products predicted. At microwave frequencies such large values are not expected because of the effects of diode lead inductance and the selectivity of the associated microwave circuits. Methods for minimizing these effects are considered. G.D.Sims

621.375.9 : 621.314.6

SUPERCONDUCTING RECTIFIER AND AMPLIFIER. See Abstr. 73

621.375.9

356 SUPERREGENERATIVE OPERATION OF PARAMETRIC AMPLIFIERS. J.J.Younger, A.G.Little, H.Heffner and G.Wade.
I.R.E. WESCON Convention Record, Vol. 3, Pt 1, 108-11 (1959).

See also Abstr. 7370-1 (1959). Superregenerative operation of

simple single-diode cavity amplifiers confirms that high gain can be obtained with considerably improved stability and bandwidth compared with what would be expected from conventional c.w. operation. Experiments are discussed similar to those previously reported on a 780 Mc/s amplifier and an S-band amplifier both with separate quenching and with self quenching, the latter being obtained by operating the diode without a d.c. return path. G.D.Sims

MODULATION . DEMODULATION

621.376 : 621.396.4

357 INTER-RELATION AND COMBINATION OF VARIOUS TYPES OF MODULATION. W.D.Meewezen.

Proc. Instn Radio Engrs Australia, Vol. 20, No. 10, 582-90 (Oct., 1959).

An examination of the frequency distribution of the power in typical broadcast signals shows that low-deviation phase modulation should have advantages over amplitude and frequency modulation. A method of stereo broadcasting is also proposed in which the sum of the two channels is transmitted as a.m. and the difference as p.m.

621.376.223

358 RECTIFIER MODULATORS WITH FREQUENCY-SELECTIVE TERMINATIONS.

D.P.Howson and D.G.Tucker.

Proc. Instn Elect. Engrs, Paper 3051E, publ. Dec., 1959, 12 pp. To be republished in Vol. 107B (1960).

Solutions are obtained for the modulation-product currents in series- and shunt-type rectifier modulators by separating out an equation for each possible modulation-product frequency and by assuming (a) square-wave switching of non-reactive rectifiers, and (b) signal-path terminating impedances which are a pure but not necessarily constant resistance — or zero or infinite — at each modulation-product frequency involved. The conditions under which there are no even-order modulation-product currents are determined, and the influence of such currents when they do exist is examined. Experimental results confirm the theory. It is shown that all the working and conclusions apply exactly to the ring modulator, provided that terminations required for odd-order modulation-product frequencies are applied in the output loop and those required for even-order frequencies are applied in the input.

621.376.223 : 621.374.32

359 THE USE OF SILICON DIODES IN D.C. MODULATORS AND THEIR APPLICATIONS TO DRIFT CORRECTORS FOR COMPUTING AMPLIFIERS. T.Glucharoff and C.P.Gilbert.

Proc. Instn Elect. Engrs, Monogr. 346M, publ. Oct., 1959, 9pp. To be republished in Part C.

The basic computing element of an electronic analogue computer is the high-gain d.c. amplifier, but in order to overcome its inherent drift some form of auxiliary drift-correcting amplifier is frequently used. Describes a silicon diode modulator for use in such drift correctors, and shows that the zero stability which can be achieved is comparable with that given by the conventional relay modulator. It is also shown that the use of the diode circuit results in a number of improvements in the overall drift-corrector performance, such as a higher frequency response and practically unlimited life; the design of such a drift corrector for use with a given d.c. amplifier is described in detail and the resulting performance is assessed.

621.376.232.2

360 DIODE PHASE-SENSITIVE DETECTORS WITH LOAD. R.Chidambaram and S.Krishnan.

Electronic Engng, Vol. 31, 613-16 (Oct., 1959).

A theoretical investigation of the operation of the simple diode push-pull phase-sensitive detector with load is carried out. The transfer ratios for the two diodes are found to vary considerably with the signal. The non-linearity in the output due to these variations is evaluated and a table is given from which the suitability of a given detector may be judged immediately. Experiments confirm quantitatively the theoretical results.

621.376.234

361 THE INPUT IMPEDANCE OF RECTIFIER MODULATORS. D.G.Tucker.

Proc. Instn Elect. Engrs, Paper 3187E, publ. Jan., 1960, 9 pp. To be republished in Vol. 107B (1960).

It is shown how the input impedance of a rectifier modulator of series, shunt or ring type can be calculated, and a large number of cases are tabulated, assuming: (a) that the terminating impedances, while being as frequency selective as desired, are nevertheless purely resistive at all modulation-product frequencies where they are not zero of infinite; and (b) that the rectifiers have a square-wave variation of resistance with time. It is clearly shown that in all cases except one (i.e. a ring modulator with constant-resistance load) the input impedance — defined as the ratio of the input voltage to the input current at the applied signal frequency — has the peculiar property of being dependent on the nature and magnitude of the signal-source impedance from which it is being measured.

621.376.5

362 A DELTA MODULATION SYSTEM USING JUNCTION TRANSISTORS. B.E.Williams.

Electronic Engng, Vol. 31, 674-80 (Nov., 1959).

A delta modulation system, operating at a digit frequency of 14 kc/s, is described which provides a simplex speech link with good intelligibility. The equipment has only one manual control, the press-to-talk switch, other adjustments being preset or made automatically. The receiver regenerates the incoming signal by voltage and time slicing before feeding the decoder. The equipment will work satisfactorily over a wide range of ambient temperatures and is suitable for use over equalized lines or radio links. A power supply of between 6 and 12V is required.

621.376.5

363 USING MAGNETIC CIRCUITS TO PULSE RADAR SETS. A.Krinitz.

Electronics, Vol.32, No.27, 42-3 (July 3, 1959).

Describes a radar modulator which uses transistor drive and square-loop magnetic cores to generate and shape pulses. The experimental generator gave a 1 μsec pulse with a peak output power of 5.6 kW at a recurrence frequency of 1 700 c/s. Overall weight 10 lb. P.Collins

621.376.53 : 621.374.3

AN INVESTIGATION INTO SOME ASPECTS OF DIODE QUANTIZING CIRCUITS. See Abstr. 308

621.376.55 : 621.396.41

364 A 45 CHANNEL P.P.M. SYSTEM. S.Schreiner and B.McAdams.

I.R.E. Nat. Convention Record, Vol. 6, Pt 8, 225-9 (1958).

The multiplexer comprises two groups of 23 modulators. In the second group, modulator 23 is omitted to avoid interference with the framing pulse. Pulse position modulation is effected by 8 kc/s sampling of the audio signals, and zero-crossing detectors. Received signals are converted to pulse-width modulation by combining the leading edge of a channel gate with the position-modulated channel pulse, and the audio signal is recovered by means of a low-pass filter. Plug-in, etched wiring units are used and a 23-channel group requires 38½ in. height in a 19 in. rack. W.G.Stripp

ELECTRONICS

SEMICONDUCTOR MATERIALS AND DEVICES
TRANSISTORS

621.382 : 548 : 539.2

365 CRYSTALLOGRAPHIC ORIENTATION OF SEMICONDUCTORS. S.Marshall.
B.T.-H. Activ., Vol. 30, No. 4, 170-4 (July-Aug., 1959).

Describes a simple optical technique, claimed to be accurate to about 2 minutes of arc, which depends upon the reflection of a parallel beam of white light by the low-index crystallographic planes produced by suitably etching a lapped surface, the reflected beam being arranged to retrace the path of the incident beam through a lens to a pinhole in an observation screen. F.F.Roberts

621.382

366 COMPOUND SEMICONDUCTORS. D.A.Wright.
Electronic Engng, Vol. 31, 659-65 (Nov., 1959).

Discusses first the more important parameters governing the behaviour of semiconductors. These considerations are then applied to the various types of semiconducting compound which have so far been studied, and values of the mean parameters are quoted. The usefulness of the materials for different applications is discussed in the light of these figures. In each type of compound, definite trends are observed in the relationship between the semiconducting parameters and other physical properties. These trends are described and their interpretation is indicated. The parameters which are important for thermoelectric applications are mentioned briefly, together with the bearing of the earlier discussion on the choice of materials for these applications.

621.382

367 THE PREPARATION OF SINGLE-CRYSTAL SILICON FOR THE PRODUCTION OF VOLTAGE-REFERENCE DIODES. G.Ashton and M.H.Issott.
Proc. Instn. Elect. Engrs. Paper 3083E, [International Convention on Transistors and Associated Semiconductor Devices], publ. 1960 (Part B Suppl. 15, 273-6).

Silicon crystals with phosphorus concentrations up to 1.5×10^{19} atoms per cubic centimetre have been prepared by the Czochralski technique. The phosphorus was added either in the form of ammonium orthophosphate or by means of a silicon-phosphorus alloy containing approximately $1\frac{1}{2}\%$ phosphorus. It is shown that the use of such an alloy as the doping agent results in improved control of the phosphorus concentration compared with the results obtained with ammonium orthophosphate. Aluminium-wire-type alloyed diodes were prepared using silicon with phosphorus concentrations from 2×10^{18} to 1.5×10^{19} atoms per cubic centimetre. The breakdown voltage of these diodes was found to be dependent on the phosphorus concentration up to 3×10^{18} atoms per cubic centimetre. At concentrations greater than this, the breakdown voltage was found to be sensitive to the alloying conditions. The mechanism of the formation of the p–n junction in silicon with phosphorus concentrations greater than 3×10^{18} atoms per cubic centimetre is discussed.

621.382 : 537.311 : 539.2

368 THE STATE OF ETCHED SEMICONDUCTOR SURFACES AS REVEALED BY ELECTRON DIFFRACTION. P.J.Holmes and R.C.Newman.
Proc. Instn Elect. Engrs, Paper 2998E [International Convention on Transistors and Associated Semiconductor Devices], publ. 1960 (Part B Suppl. No. 15, 287-92).

Germanium and silicon (100) and (111) surfaces have been etched with a variety of reagents and subsequently examined by reflection electron diffraction. No oxide layers were detected on surfaces etched with the common mixtures containing hydrofluoric and nitric acids. When metal ions were present, either as essential components or as impurities in the etchants, deposits, either of the metals or of compounds, were sometimes found; in particular, contamination from materials commonly used for making contacts to devices has been found. No preferential deposition was found on either side of an etched p–n junction. Details of the sensitivity of electron diffraction are included as an appendix.

621.382

369 DISLOCATION PLANES IN SEMICONDUCTORS. H.F.Mataré
Proc.Instn Elect. Engrs, Paper 2967 E [International Convention on Transistors and Associated Semiconductor Devices], publ. 1960 (Part B Suppl. No. 15, 293-302).

Dislocations and mainly dislocation planes as the most important non-chemical imperfections in semiconductor crystals are discussed from the aspect of their influence on carrier transport. After a short review of the general properties of grain-boundary planes of medium angle of misfit, the effects are discussed, including the barrier behaviour, the band structure and lifetime anisotropy. Device structures based on these properties of dislocation planes are described, among which the dislocation-field-effect transistor shows promising features as the first temperature-independent transistor in the range 300-2°K.

621.382.2

370 ENVELOPE DESIGN FOR SEMICONDUCTOR DEVICES. A.Lindell.
Proc. Instn Elect. Engrs, Paper 3103 E [International Convention on Transistors and Associated Semiconductor Devices], publ. 1960 (Part B Suppl. No. 15, 463-9).

Semiconductor devices have high-current low-voltage characteristics, are very temperature dependent, are basically very small and robust and must be hermetically sealed. Further, they cover a frequency range up to about 100 Gc/s, voltages up to thousands of volts, currents up to hundreds of amperes and a temperature range of the order of ±200°C. The effect of these factors on the envelope design is discussed and the choice of metals and insulators for the envelope is considered. A strong case is made out for the extensive use of copper. Its high electrical and thermal conductivities, the ease with which it can be cold welded, its ready availability in a high-purity state and the availability of copper-sealing glass are all enlarged upon. Of the three possible insulators, glass, ceramics and plastics, the case of glass is discussed in some detail. Finally, some thought is given to mechanical standardization of outline dimensions of semiconductor devices with similar electrical characteristics made by different manufacturers. The difficulties are noted and possible degrees of standardization are indicated.

621.382 : 537.311 : 539.2

371 SOME EFFECTS OF PULSE IRRADIATION ON SEMICONDUCTOR DEVICES. W.A.Bohan, J.D.Maxey and R.P.Pecoraro.
Proc. Instn Elect. Engrs, Paper 3124E [International Convention on Transistors and Associated Semiconductor Devices], publ. 1960 (Part B Suppl. No. 15, 361-7).

The effects of pulse irradiation upon majority and minority carrier properties of semiconductor devices are presented, with emphasis on those effects peculiar to radiation rates of the order of 10^{16} neutrons/cm^2 per second and 10^7 röntgens (γ)/sec. Experimental data and semiconductor theory are employed to obtain an expression for the dependence of device parameters on integrated neutron exposure in germanium and silicon. Comparisons are made of the effects produced by neutrons and γ-rays. Experimental data for the transient photovoltaic effect observed in junction devices under pulse irradiation are discussed on the basis of current theory.

621.382

372 THE INFLUENCE OF SURFACE PROPERTIES ON THE CHARACTERISTICS OF FORMED POINT CONTACTS ON P-TYPE GERMANIUM. B.H.Clausen.
Proc. Instn Elect. Engrs, Paper 2935E, [International Convention on Transistor and Associated Semiconductor Devices], publ. May,1959 (Part B Suppl. No. 15, 282-6, 329-30).

Republication, with discussion, of the paper abstracted in Abstr. 3001 (1959).

621.382.2 : 621.316.91 : 621.314.63

THE CHARACTERISTICS AND PROTECTION OF SEMICONDUCTOR RECTIFIERS. See Abstr. 76

621.382.2 : 621.374.33

HIGH-SPEED COMPUTER CIRCUITS USING CARRIER STORAGE IN SILICON DIODE FOR ENHANCED TRANSIENT RESPONSE. See Abstr. 331

621.382.23 : 621.314.63

DESIGN CONSIDERATIONS IN THE DEVELOPMENT OF SILICON POWER RECTIFIERS. See Abstr. 78

621.382.232

373 SOME FUNDAMENTAL ASPECTS OF p–n JUNCTIONS. A.C.Sim.

Proc. Instn Elect. Engrs, Paper 2990E [International Convention on Transistors and Associated Semiconductor Devices], publ. 1960 (Part B, Suppl. No. 15, 357-60).

It is pointed out that in many practical p–n junctions the internal field strengths and dimensions are such that the diffusion equation for the current which is commonly applied is seriously in error. In consequence, it is suggested that no valid analysis has yet been made of p–n junction characteristics, and that a major advance in statistical theory is necessary before this becomes possible. It is also suggested that it is to be expected that there will be a significant difference between germanium and silicon junction devices in their characteristic-material relationships.

621.382.232

374 TUNNEL DIODES FOR LOW NOISE AMPLIFICATION. H.S.Sommers, Jr., K.K.N.Chang, H.Nelson, R.Steinhoff and P.Schnitzler.

I.R.E. WESCON Convention Record, Vol. 3, Pt 3, 3-8 (1959).

Very briefly reviews the structure and characteristics of the tunnel diode, outlines its use as an amplifier and gives an estimate of its noise figure, assuming that 1/f noise may be neglected above about 1 kc/s. Some experimental results for a 30 Mc/s amplifier are included. F.F.Roberts

621.382.3

375 TRANSISTORS IN MAGNETIC FIELDS. EFFECT ON CHARACTERISTICS. P.C.Trivedi and G.P.Srivastava.

Electronic Radio Engr, Vol. 36, No. 10, 368-70 (Oct., 1959).

The characteristics of p–n–p alloy junction transistors, connected in a common-emitter amplifier configuration with normal fixed bias, have been studied when the transistors are subjected to a magnetic field. The current amplification factor is measured in the audio-frequency region. As far as the cut-off frequency is concerned, the behaviour is entirely different from the behaviour of point-contact transistors. Cut-off frequency is not materially affected by the magnetic field, which contrasts with point-contact transistors in which a shift in the cut-off frequency is observed, depending upon the direction of the applied transverse field. Further, it has been found that the value of α' decreases with the transverse field, falling by about 10%, with a change of field of approximately 8 kG. Longitudinal fields do not show marked effect in audio-frequency transistors, but an increase in current gain has been observed in radio-frequency transistors.

621.382.3

376 A PERFORMANCE/COST APPROACH TO TRANSISTOR DESIGN. S.O.Johnson.

Proc.Instn Elect. Engrs, Paper 2999 E [International Convention on Transistors and Associated Semiconductor Devices], publ. 1960 (Part B Suppl. No. 15, 370-4).

The customer is interested in the overall performance and the cost of transistors and this requires a more sophisticated design approach aimed at high performance at low cost. For the high-frequency high-power market, the transistor designer is technically limited in his choice of junction formation methods, and the cost of products is high. For those markets where many techniques compete, the performance/cost design approach is essential; the low-frequency low-power market particularly warrants this approach at this time. For the low-frequency low-power market, where several techniques can yield the same performance, the designer must consider the various methods of forming junctions and making contants, and the mechanical design, including the housing, in terms of the cost factors. The various design elements will be described and analysed with respect to the cost factors reflected by process complexity, product reproducibility and design flexibility. Particular emphasis is placed on a comparison of the three basic junction-formation techniques—alloy, grown and diffused. This analysis indicates, on a performance/cost basis, that alloy and grown types of transistors have, and will have for many years, an important share of the computer, audio and broadcast radio-frequency and intermediate-frequency markets. Consideration of the high-frequency high-power markets, and the inevitable simplification of the relatively new diffusion process, leads to the conclusion that all three basic techniques will be required to obtain the broadest market coverage in the expanding transistor market.

621.382.3

377 SECTIONING AND FAULT ANALYSIS OF JUNCTION TRANSISTORS. B.A.I.Davis and D.L.Lynton.

Proc. Instn Elect. Engrs, Paper 2994 E [International Convention on Transistors and Associated Semiconductor Devices], publ. 1960 (Part B Suppl. No.15, 445-6).

Special techniques have nrecently been developed by the authors to enable microsections to be readily made on high-frequency p–n–p and p–n–i–p– junction transistors. It is impossible to use standard metallographic techniques when sectioning these devices, owing to the extreme fragility of the very thin germanium wafers used in their fabrication. Wafers as thin as 0.001 in may be encountered, and it has been found necessary to encapsulate the specimens in two stages, using different resins, to ensure adequate support of the wafer edges and so avoid chipping of the wafers during the subsequent grinding and polishing operations. A detailed grinding and polishing procedure has been developed to give optimum surface finish. The junction structure can finally be shown up by preferential etching. After preparation, the specimens can be microscopically examined, photographed and much valuable information extracted concerning the wetting, alloy penetration, recrystallization, crystal orientation and junction geometry. It is possible to examine the effect of the final clean-up etch used during manufacture, and in some cases to explain soft reverse-junction characteristics. Describes the preparation of large numbers of sections on a routine basis, using these techniques, and a number of examples are shown and typical faults discussed. The information obtained from these samples has proved of considerable value, particularly during the early stages of any new development.

621.382.3 : 621.327.534

THE APPLICATION OF POWER TRANSISTORS TO THE OPERATION OF GAS-DISCHARGE LAMPS FROM D.C. SUPPLIES. See Abstr. 219

621.382.333

378 SWITCHING TRANSISTORS. I.M.Ross.

Western Joint Computer Conference (see Abstr. 4755 of 1959). p. 93-5.

The symmetry and low lead resistance of alloy-type transistors make them very suitable for switching purposes. Normal switching operation in saturation is described and the important transistor parameters listed. These are collector leakage current, breakdown voltage and saturation voltage, and current amplification. The factors limiting switching speed are detailed and the importance in this respect of circuit design stressed. The recent four-region devices show promise as diode switches operated by luminous energy or by small voltage transients and may be incorporated into counter circuits of small size operating at 10^9 counts/sec. G.H.Stearman

621.382.333.3

379 INFLUENCE OF TECHNOLOGY AND OF DIFFUSION ON THE CHARACTERISTICS OF A DRIFT TRANSISTOR. J.Mercier.

Ann. Radioelect., Vol. 14, 322-38 (Oct., 1959). In French.

Reviews the theory of the dependences of f_α, f_1 and the emitter charge storage capacitance C_s on the drift field, discusses the effects of emitter penetration on emitter efficiency and base resistance, and considers measurements on real transistors in relation to the parameters of equivalent circuits. The implications of the analyses as to the limitations in overall performance obtainable with feasible technology are examined F.F.Roberts

621.382.333.3

380 CHARTS FOR DERIVING TRANSISTOR R-PARAMETERS FROM H-PARAMETERS. G.W.E.Stark.

Electronic Engng, Vol. 31, 592-3 (Oct., 1959).

621.382.333.3

381 TRANSISTOR 'h' PARAMETERS. R.Hutchins and J.D.Martin.

Electronic Radio Engr, Vol. 36, No. 10, 383-7 (Oct., 1959).

Describes an experimental investigation made in order to develop a test-set suitable for the measurement of the complex parameters of the quadripole representing the linear performance of a transistor with small-signal input.

PHOTOELECTRIC DEVICES

621.383

382 SUITABILITY OF GERMANIUM PHOTODIODES AND PHOTOTRANSISTORS FOR PHOTOMETRY. K.Eckhardt.

Lichttechnik, Vol. 11, No. 9, 478-82 (Sept., 1959). In German.

The characteristics of Ge photodiodes and phototransistors are described, with particular reference to their use in photometry. It is concluded that the transistors, on account of their high sensitivity to temperature and their slow response, are not suitable for precise work in this field. Ge photodiodes are not well adapted to ordinary photometry because of their spectral sensitivity curve, which has its maximum at 1.6 μ. They may, however, have special applications, especially where a receptor of very small area is required.

J.W.T.Walsh

621.383 : 539.2 : 537.311

383 A NOTE ON THE USE OF FILTERS IN PHOTOCONDUCTIVE DECAY MEASUREMENTS. A.C.Sim.

Proc. Instn Elect. Engrs, Paper 2885E [International Convention on Transistors and Associated Semiconductor Devices], publ. May, 1959 (Part B Suppl. No. 15, 308-10, 329-30).

Republication, with discussion, of the paper abstracted in Abstr. 3035 (1959).

621.383.2.032.35

384 SOME NEW TECHNICAL ASPECTS OF ELECTROLUMINESCENCE. G.Destriau.

Bull. Soc. Franc. Elect., Vol. 9, 383-8 (July, 1959). In French.

An account of some well-known aspects of electroluminescence, including efficiency, waveforms and the X-ray image intensifier. The emission of ZnS:Mn of yellow electroluminescence is shown to consist of a modulated component and a steady one, the latter increasing continuously with frequency and the former reaching a maximum at ~ 600 c/s and declining rapidly at higher frequencies.

S.T.Henderson

621.383.4 : 537.533

385 THE DESIGN OF SINGLE-CRYSTAL INFRA-RED PHOTOCELLS. C.Hilsum and O.Simpson.

Proc. Instn. Elec. Engrs, Paper 2965E [International Convention on Transistors and Associated Semiconductor Devices], publ. 1960 (Part B Suppl. 15, 398-401).

Explicit formulae are given for the sensitivity of single-crystal photocells used as photoconductive, photoelectric and p—n junction detectors. The equivalent noise input can be expressed as the product of functions depending on the bulk and surface properties respectively. The parameters governing the design of photocells of high sensitivity are discussed, and the results are applied to the semiconductors indium antimonide, indium arsenide and lead sulphide. It is shown that the best mode of operation for a semiconductor may be inferred from the carrier mobility, lifetime and surface recombination velocity.

621.383.4

386 PHOTO-RESISTORS MADE OF COMPRESSED AND SINTERED CADMIUM SULPHIDE. N.A.de Gier, W.van Gool and J.G.van Santen.

Philips tech. Rev., Vol. 20, No. 10, 277-87 (1958-59).

The basic material for these devices is very pure powdered CdS (grain size 0.1 μ); to this certain substances containing copper and gallium are added, the mixture being subjected to a heat treatment. The result is a coarse powder made up of grains measuring 10 to 100 μ, in which the additives are now uniformly distributed; this is compressed into plates of the desired shape. Lattice defects arising during the pressing process (and which reduce the photosensitivity of the substance) are largely removed or modified in a second heat treatment, which causes the grains to cohere. Photoresistors made of this material have a sensitivity (A/lux) approaching that of the photomultiplier, far exceeding that of other types of photocell, and varying little with temperature. CdS photo-resistors can be used to operate relays directly. The applications of the device include flame monitoring and the construction of crackle-free potentiometers which can be remote-controlled.

PARTICLE ACCELERATORS

621.384.613

387 THE APPLICATION OF THE BETATRON IN MEDICAL RADIOLOGY. R.Widerøe.

Elektrotech. Z. (E.T.Z.) B, Vol. 11, No. 7, 281-5 (July 21, 1959). In German.

A review of the development of supervoltage apparatus for therapy is given, followed by a description of the Brown Boverie 35 MeV betatron, the "Asklepitron". This machine which generates high energy electrons or X-rays is stated now to be a thoroughly reliable device with a cathode life of 5000 hr or more, and is cheaper than the linear accelerator. The Asklepitron is mounted on a moving gantry for rotation therapy and incorporates a 120 kV diagnostic tube for checking of beam direction.

F.T.Farmer

ELECTRON TUBES

621.385.1

388 EFFECTS OF NUCLEAR RADIATION ON ELECTRON TUBE MATERIALS. E.R.Johnson.

I.R.E. WESCON Convention Record, Vol. 3, Pt 8, 70-2 (1959).

Considers the effect of nuclear radiation at moderate levels (10^{-2} neutrons/cm^2) for long periods of time on electronic tubes. For the purpose of analysis the tube is considered in terms of the envelope, metallic parts and cathode coating. Glass tends to heat up considerably under bombardment whereas metallic parts are hardly affected. Cathodes are not directly affected but secondary effects, e.g., the evolution of gas by secondary heating effects, may poison the cathode. Photo-tubes, iconoscopes, etc., have practically no resistance to radiation damage.

T.Mulvey

621.385.623.5

389 SPACE-CHARGE EFFECTS IN REFLEX KLYSTRON. M.Terada, E.Sugata and H.Hamada.

J. Inst. Elect. Commun. Engrs Japan, Vol. 42, No. 6, 591-7 (June, 1959). In Japanese.

A method of successive approximation is applied to the analysis of space-charge effects in reflex klystrons. Expressions are derived for the space-charge correction factor F_{θ_e} for the bunching angle θ_e and for the correction factor F_θ for the phase angle θ. In the case where the transit cycle N is rather large, the bunching efficiency $F = F\theta_e/F_\theta$, which measures the bunching effectiveness of the reflection field, can be expressed approximately as

$$F = 1 + 8.37 \times 10^{13} \frac{I_0}{f^2 \sqrt{V_0}} N^2 \log(2\pi N)$$

where I_0 is the d.c. current density in A/m^2, V_0 is the accelerating voltage in volts and f is the oscillation frequency in c/s. Comparison of calculations with published experimental results confirms the theory.

A.Wilkinson

621.385.624.2

390 AN EXPERIMENTAL INVESTIGATION OF A TWO-CAVITY KLYSTRON OPERATING UNDER LARGE-SIGNAL CONDITIONS. I.M.Stephenson.

Proc. Instn Elect. Engrs, Paper 3130 E, publ. Jan., 1960 (Vol. 107 B, 60-5).

An experimental 2-cavity klystron with a variable drift space has been constructed to investigate velocity-modulated electron beams. The operating frequency is 300 Mc/s. Previous experimental work with this valve has shown that the space-charge-wave theory accurately predicts both the optimum drift length and the output r.f. current, provided that small signals are used. Recent theoretical work on large-signal conditions has enabled some experimental results with large signals to be compared with calculations for similar, though not quite identical, conditions. Both the experiments and the theory show that the optimum drift length is considerably reduced when the input signal is large. The parameter that determines whether the signal is large is not merely the ratio of the modulating r.f. voltage to the beam accelerating voltage but is this quantity multiplied by the ratio of signal frequency to plasma frequency.

621.385.624.2

391 A SIMPLE INVESTIGATION OF THE CROSS-MODULATION DISTORTION ARISING FROM THE PULLING EFFECT IN A FREQUENCY-MODULATED KLYSTRON. D.T.Gjessing.
Proc. Instn Elect. Engrs, Paper 2789 R, publ. Jan., 1959 (Vol. 106B, 473-7. 492-4).

Republication, with discussion, of the paper abstracted in Abstr. 1052 (1959).

621.385.624.3

392 A MULTI-CAVITY KLYSTRON WITH DOUBLE-TUNED OUTPUT CIRCUIT. H.J.Curnow and L.E.S.Mathias.
Proc. Instn Elect. Engrs, Paper 2825 R, publ. Jan., 1959 (Vol. 106 B, 487-8, 492-4).

Republication, with discussion,of the paper abstracted in Abstr. 1053 (1959).

621.385.63

393 THEORY AND BEHAVIOUR OF HELIX STRUCTURES FOR HIGH-POWER PULSED TRAVELLING-WAVE TUBE. G.W.Buckley and J.Gunson.
Proc. Instn Elect. Engrs, Paper 2788 R, publ. Jan., 1959 (Vol. 106B, 478-86, 492-4).

Republication, with discussion, of the paper abstracted in Abstr. 1039 (1959).

621.385.633.1

394 TRANSFER FUNCTION OF THE O-TYPE BACKWARD-WAVE OSCILLATOR. I.Sakuraba.
J.Inst.Elect.Commun. Engrs Japan, Vol.42, No.8, 750-4 (Aug.,1959). In Japanese.

The transfer function is calculated under the assumption that the tube acts as a linear device and that the steady-state frequency response can be approximated by a power-series expansion of a pair of poles. The general form of the transfer function $Y_{(p)}$ of a tube is given by the relation $Y_{(p)} = Y_{i(p)} \cdot Y_{s(p)}$, where $Y_{(p)}$ is the transfer function of the interaction between the beam and the r.f. signal and $Y_{s(p)}$ is the transfer function of the "dead time" or transportation lag. A.Wilkinson

621.385.633.12

395 VOLTAGE TUNABLE MILLIMETER-WAVE OSCILLATORS. D.J.Blattner and F.Sterzer.
Electronics, Vol. 32, No. 25, 62-3 (June 19, 1959).

Experimental backward-wave oscillator tubes are described which can be tuned over a wide frequency range by a single voltage adjustment. The tubes utilize a helical slow-wave structure wound with rectangular cross-section tape. Two designs described cover 29 to 49 kMc/s with power output from 5 to 13 mW and 48 to 74 kMc/s with output from 1.2 to 2.6 mW.

621.385.834

396 NEWLY DEVELOPED CATHODE-RAY OSCILLOGRAPH TUBES AND THEIR APPLICATION IN HEAVY- AND LIGHT-CURRENT TECHNOLOGY. R.Feinberg.
Elektrotech. u. Maschinenbau (E.u.M.), Vol. 76, No. 15-16, 373-8 (Aug. 15, 1959).

621.386.22

397 DISTANT-FOCUS X-RAY TUBES. A.H.G.Kuntke.
Philips tech. Rev., Vol. 20, No. 10, 291-8 (1958-59).

In normal X-ray tubes the electrons are focused with a two-electrode system. It is shown that this is still possible where the electron trajectories are very long, e.g. up to 600 or 800 mm as in rod-anode tubes. For this purpose a wide and deep "cathode cup" is placed in front of the filament, itself mounted in a slot in the cathode block. The cathode cup acts as an auxiliary lens. The electrons from the filament can be imagined to originate from a virtual object behind the cathode, i.e. a virtual "image" produced by the slot-filament electron-optical system and having a fairly uniform electron distribution. The auxiliary lens produces on the target an image of this virtual object. The position, size and electron distribution of the virtual object are determined from experiments with a rubber membrane analogue. From the optical analogy deductions can be made concerning the cathode-cup lens. Various rod-anode X-ray tubes have been designed on the principle discussed and are briefly described.

621.386.8

398 ELECTROMECHANICAL COMPUTER FOR DIAGNOSTIC X-RAY APPARATUS.
K.Franke, E.Gulden and H.Heuse.
Elektrotech. Z. (E.T.Z.) B, Vol. 11, No. 7, 294-7 (July 21, 1959). In German.

Methods of interlinking of controls to simplify selection of exposure factors and to safeguard the tube against overloads are discussed. A system is described by which the time constants of tube heating as well as the interaction between tube current and voltage are fed in to an electromechanical computer. A very simple form of control unit is thus provided for radiology. F.T.Farmer

621.386.832

399 PROBLEMS OF AUTOMATIC EXPOSURE CONTROL IN DIAGNOSTIC RADIOLOGY.
W.Fussangel, O.Schott and K.Ungerer.
Elektrotech. Z. (E.T.Z.) B, Vol. 11, No. 7, 290-4 (July 21, 1959). In German.

The two systems in use, employing an ionization chamber and fluorescent screen respectively, are described, and problems of proper working are discussed. The ionization chamber collects a charge of the order of 10^{-10} C and is subject to switching surges and leakage difficulties. Either system needs to be directed to a "dominant" area in the radiograph and the methods of achieving this are described. F.T.Farmer

621.386.842

400 THE X-RAY IMAGE INTENSIFIER FOR MEDICAL USE. H.Mohr.
Elektrotech. Z. (E.T.Z.) B, Vol. 11, No. 7, 286-90 (July 21, 1959). In German.

A description of the Philips image intensifier and its adaptation to radiology is given. The 5 in tube gives a magnification (relative to ordinary screens) of 1000 times. The 11 in tube is suitable for cine work only, but an 8½ in tube is made for direct viewing, cine or television working. The latter technique is advantageous in allowing contrast control and observation by several persons at once. F.T.Farmer

GAS DISCHARGES
GAS-DISCHARGE TUBES

621.387

401 CHARACTERISTICS OF ARGON NOISE SOURCE TUBES AT S-BAND. W.J.Medd.
I.R.E. Trans Microwave Theory and Tech., Vol. MTT-7, No. 3, 395 (July, 1959).

The results of tests on argon plasma noise source discharge tubes are described. R.C.Glass

ELECTRONIC EQUIPMENT

621.389

402 SURVEY OF JAPANESE ELECTRONIC DEVICES. L.Solomon.
Electronics, Vol. 32, No. 37, 109-11 (Sept. 11, 1959).

Reviews briefly transistorized a.m./f.m. portable radio receivers, transistorized television receivers, coin-size rechargeable cells and other equipment. A talking book, embodying magnetic recording technique, is described in detail. The book is actually in the form of a book with illustrations on one side of the page and a magnetic coating on the other. Recording and playback is effected by placing the book in position on the machine with the particular page resting on top of a turntable which carries an array of three heads arranged symmetrically round the edge. As the turntable rotates, each head in turn comes in operation, the book moving slowly up or down at the same time. The max. recording time for one page is ten minutes. H.G.M.Spratt

621.389

403 MICROMINIATURIZATION WITH REFRACTORY METALS. D.A.McLean.
I.R.E. WESCON Convention Record, Vol. 3, Pt 6, 87-91 (1959).

A new concept is described in which integrated circuits consisting of capacitors and resistors are produced in situ on a glass or ceramic substrate from a single metal. Most work to date has

been done with Ta which is outstanding. Capacitors are produced by anodizing sputtered Ta film and applying an evaporated counter electrode such as gold or aluminium. Capacitors for 50 V operation are about 0.1 $\mu F/cm^2$. Insulation resistance at 75 V is about 3000 ohm farads, with a dissipation factor of 1% or less. Anodically grown Ta_2O_5 gives a working voltage of about 7000 V/mil and a dielectric constant of 25. Sputtered Ta possesses little crystalline structure which probably accounts for its properties as a resistance element. The specific resistance is 7 times that of the bulk metal and the temperature coefficient is only one thirtieth. The film reacts with oxygen to give a thin film of oxide and the resistance increases. It then receives a thermal stabilization treatment. A special method had to be developed for printed circuit work since Ta is extremely resistant chemically. The substrate is first completely covered with a thin layer of copper which is then removed as desired by standard photoengraving methods. Ta is then sputtered over the whole surface. When immersed in etchant all copper is removed together with overlying Ta leaving Ta only where the substrate had been bared. A photo of a 2 in × 2 in ceramic board is shown containing 24 resistors up to 121 kΩ, nine 0.01 μF capacitors and plug-in arrangements for 6 transistors and 9 diodes. This gives a passive component density of 275 000 parts/ft^3. Photographs showing the method of production are given. B.B.Austin

621.389.049.75

404 NETWORK DESIGN OF MICROCIRCUITS. C.K.Hager.

Electronics, Vol. 32, No. 36, 44-9 (Sept. 4, 1959).

Microcircuits are made by vacuum deposition of a resistive film on one side of a thin dielectric wafer with either a resistive or conductive film on the other side. In this way distributed RC networks can be built up. The areas and thicknesses of the films can be varied, the resultant networks being very unlike those using lumped resistors and capacitors. The transfer characteristics of several such networks are discussed and compared in respect of phase and amplitude responses with comparable lumped constant networks. Typical transistor circuits using the technique are described, which it is claimed will result in new degrees of miniaturization, producibility and reliability. A.P.C.Thiele

621.389.049.75

405 PRINTED WIRING FOR ELECTRONIC DIGITAL CIRCUITS. C.van Holten and R.M.M.Oberman.

Ingenieur, Vol. 71, No. 42, E.131-E.139 (Oct. 16, 1959). In Dutch.

Double- and single-sided printed circuit assembly plates are compared. Soldering difficulties lead to a preference for single-sided printing. The systematic solution of wire crossing problems is explained with reference to standard unit assembly plates, and their use for the circuit of two master and slave elements of a computer and a 6-diode gate circuit are illustrated. G.N.J.Beck

621.389.049.75

406 INSULATED FLEXIBLE PRINTED WIRING TECHNIQUES. W.B.Wilkens.

I.R.E. Nat. Convention Record, Vol. 7, Pt 6, 10-18 (1959).

A review of the more complex design information relating to techniques developed to facilitate the construction of more complicated wiring assemblies and to extend the scope of application of flexible printed wiring, including improved methods of soldering and attachment. Topics discussed include multi-layer construction, matrix construction, shielded cables, coaxial cables, cables for oscillating devices, long cables, preformed cables, fine line wiring, methods of attachment (welding and soldering) and connections of various types. H.A.Miller

621.389.049.75

407 INVESTIGATION OF PRINTED CIRCUIT BOARD SOLDERED JOINTS.

R.H.Hronik, S.Levine, P.A.Thompson and W.M.Verbeck.

I.R.E. WESCON Convention Record, Vol. 3, Pt 6, 77-85 (1959).

An attempt to determine reasons for failure of soldered joints on etched circuit boards. The boards investigated were 0.062 in. thick, of average size 6 by 11 in. top-flanged, glass–epoxy base with double-sided circuitry and eyelet mounted components. The work was divided into two parallel tasks, one attacking the area of materials, methods and processes; the other, configuration and design problems. Tests were made on 84 standard module boards with 13 different methods of attachment for components, both hand and dip soldering, and 3 types of solder (63/37 eutectic, 60/40 eutectic and cadmium solder). Each board was mounted with 8 flip-flop bases, 2 shift registers, 12 resistors, 4 capacitors and 15 jumpers connected in series paths to make electrical circuits for 106 soldered eyeletted joints which were directly measurable. The conclusions reached were: (1) there is no substitute for an optimum soldering system; (2) no one factor involved in the fabrication of a solder joint can be left to chance; (3) any mechanism which will introduce stress relief will insure greater fail-safe protection against failure in a poorly made solder joint; (4) any solder joint, whenever used, whether on a printed circuit, an etched circuit or in conventional wiring, is just as reliable as any other solder joint as long as the materials, techniques, processes and controls are designed to produce an optimum soldering system; (5) there is no substitute for quality. H.A.Miller

TELECOMMUNICATION

621.39

408 ON THE MEAN-SQUARE NOISE POWER OF AN OPTIMUM LINEAR DIGITAL FILTER FOR CORRELATED NOISE INPUT. M.Blum.

I.R.E. Trans Inform. Theory, Vol. IT-5, No. 2, 58-61 (June, 1959).

An asymptotic solution for the mean-square output noise power of an optimum digital filter is obtained. It is assumed that the input consists of a polynomial plus correlated noise. The asymptotic solution is found by fixing the interval between samples and allowing the number of samples to approach infinity. The solution obtained for the minimum variance filter is compared with the solution as obtained for the "least-squares filter", and it is shown that the latter filter is asymptotically efficient as compared to the former. It is shown for each of the above filters that the mean-square output noise power is proportional to the spectral density function of the correlated noise, evaluated at zero frequency, and that the factor of proportionality is the same.

621.39

409 OPTIMAL FILTERING OF PERIODIC PULSE-MODULATED TIME SERIES. W.A.Janos.

I.R.E. Trans Inform. Theory, Vol. IT-5, No. 2, 67-74 (June, 1959).

Concerns the optimal filtering of a class of input time series in which the amplitude is modulated by uniformly pulsed periodic functions. A uniform sampling of the output at a period equal to the pulsing period displays the property of time invariance. The consequent usage of bilateral Fourier–Laplace transformations and the separability of terms implicit in the time-invariant nature of the processing effectively inverts the Wiener–Hopf equation and solves the problem. The weighting function is shown to be the sum of the Wiener–Zadeh–Ragazzini solution for the unmodulated case and set of appropriately weighted delta-function-derivative terms occurring at each end point of the pulsing intervals.

621.39

410 ON SERIES OF RECTANGULAR WAVE FUNCTIONS AND THE CONCEPT OF SIGN CORRELATION. H.L.Armstrong.

I.R.E. Trans Instrumentation, Vol. I-8, No. 1, 36 (March, 1959).

It is first shown that the common idea of Fourier analysis in terms of trigonometric functions can be extended to other orthogonal functions; in particular what is called a rectangular function is introduced. It is then pointed out that in some aspects of instrumentation the idea of sign correlation is a useful concept. The actual instrument making use of the concept would employ a delay (possibly a time delay), a polarity sensitive relay (to determine sign), a reversing relay and an integrator. The multiplying device is therefore avoided. An interesting connection is also pointed out between the autocorrelation and detection of a signal. In one particular case the operation of the device is equivalent to linear detection followed by a low-pass filter. S.C.Dunn

621.39

411 DIGITAL COMMUNICATION SYSTEMS. R.L.Plouffe.

I.R.E. Nat. Convention Record, Vol. 6, Pt 8, 186-9 (1958).

The most important functions of any communication system are considered and it is shown how a communication plan can be devised to handle universally all kinds of information (voice, facsimile etc.) which can be put in a digital form. V.G.Welsby

621.39

412 SOME NEW RESULTS FOR THE PREDICTION OF DERIVATIVES OF POLYNOMIAL SIGNALS IN ADDITIVE STATIONARY NOISE. I.Kanter.

I.R.E. WESCON Convention Record, Vol. 3, Pt 4, 87-91 (1959).

The weighting function $\omega_{jn\Delta}(t)$ of memory T which yields an unbiased, lagging by Δ, least squares estimate of the j^{th} derivative of an n^{th} degree polynomial input, contaminated by stationary noise can be expressed by the series

$$\omega_{jn\Delta}(t) = \sum_{m=j}^{n} A_{mj\Delta}\omega_m(t)$$

where the functions $\omega_m(t)$ provide the best estimate in the above sense of the m^{th} derivative of an m^{th} degree polynomial (see Abstr. 3118 of 1959). Four results are derived in the present paper: (1) an explicit solution for the combination coefficients $A_{mj\Delta}$; (2) the expression for the combination coefficients at one Δ in terms of those at any other Δ^*, in particular at $\Delta^* = T/2$ corresponding to mid-point estimation; (3) the interpretation of the $A_{mj\Delta}$ as the Fourier coefficients in the expansion of the j^{th} order impulse into an infinite series of fundamental weighting functions; and (4) an interpretation of a set of Lagrange multipliers involved in the solution, as regression coefficients. G.D.Sims

621.391

413 SINGLE ERROR-CORRECTING CODES FOR ASYMMETRIC BINARY CHANNELS.

W.H.Kim and C.V.Freiman.

I.R.E. Trans Inform. Theory, Vol. IT-5, No. 2, 62-6 (June, 1959).

In a highly asymmetric binary channel it may be necessary to correct only those errors which result from incorrect transmission of one of the two code elements. Minimum weight–distance relationships and rules for generating single-error correcting codes in such situations are given. More code characters are generally obtained for a given character length than are obtained with codes designed for single-error correction in symmetric channels. Examples are given, including one which specifies the code which results in the highest average probability of correct transmission of equiprobable messages through a highly asymmetric channel.

621.391

414 THE SECOND-ORDER DISTRIBUTION OF INTEGRATED SHOT NOISE. J.Keilson and N.D.Mermin.

I.R.E. Trans Inform. Theory, Vol. IT-5, No. 2, 75-7 (June, 1959).

Shot noise, represented by a series of impulses with Poisson distribution in time, and with arbitrary time-independent amplitude distribution, is sent through an RC integrator. Time-dependent statistics of the output are investigated by means of an integro-differential equation describing the statistical flow. The exact second-order probability density of the output is obtained. The time-dependent Edgeworth series for zero initial output is exhibited, and is seen to bear a simple relation to the familiar equilibrium Edgeworth series. Results are shown to reduce to those of the Fokker–Planck equation describing integrated "white" noise as the frequency with which impulses arrive becomes infinite.

621.391

415 A THEOREM ON CROSS CORRELATION BETWEEN NOISY CHANNELS. J.Keilson, N.D.Mermin and P.Bello.

I.R.E. Trans Inform. Theory, Vol. IT-5, No. 2, 77-9 (June, 1959).

Two channels carry noise waveforms, $N_0(t) + N_1(t)$ and $N_0(t) + N_2(t)$, where $N_0(t)$ is a common narrow-band Gaussian noise and $N_1(t)$ and $N_2(t)$ are independent narrow-band Gaussian noises associated with each channel. The outputs of each channel are sent through detectors whose outputs, $F(x, y)$, are identical homogeneous functions of the components, x and y, of their inputs N, where $N(t) = x(t) \cos \omega_c t + y(t) \sin \omega_c t$. Let $R_{12}(\tau)$ be the normalized cross-correlation function of the two detector outputs. It is shown that to determine $R_{12}(\tau)$ it suffices to know the normalized auto-correlation function $R_0(\tau)$ of the output of a single such detector when the input is $N_0(t)$; i.e., if $R_0(\tau) = G(\sigma_0^2, \rho(\tau))$ where $\rho(\tau)$ and σ_0 are the normalized auto-correlation function and r.m.s. of either component of N_0, then is is shown that $R_{12}(\tau) = G(\sigma_0^2, Z\rho(\tau))$ where $Z = [\{1 + (\sigma_1^2/\sigma_0^2)\}\{(1 + (\sigma_2^2/\sigma_0^2)\}]^{-1/2}$.

621.391

416 SIGNAL-TO-NOISE RATIOS IN SMOOTH LIMITERS. J.Galejs.

I.R.E. Trans Inform. Theory, Vol. IT-5, No. 2, 79-85 (June, 1959).

Signal-to-noise ratios associated with smooth bandpass limiting and subsequent narrow-band filtering of a periodic signal and random noise are computed. Observed changes in signal-to-noise ratios may be used to estimate detectability losses. The error function is used to represent the limiter characteristic at various degrees of limiting. First-order corrections with an increasing input signal to the signal-to-noise ratios, which are based on the small signal theory, are computed for limiter input noise with sin x/x, Gaussian, and exponential correlation functions.

621.391

417 OPTIMUM ESTIMATION OF IMPULSE RESPONSE IN THE PRESENCE OF NOISE. M.J.Levin.

I.R.E. Nat. Convention Record, Vol. 7, Pt 4, 174-82 (1959).

Considers the problem of estimating the impulse response of a linear system from records of its input and output during a limited interval of time when the system output is obscured by additive random noise. Statistical estimation theory is applied to derive least squares and Markov estimates which are optimum in the sense of having minimum variance among all linear unbiased estimates. No special assumptions are required concerning the form of input. Expressions for the variances of the sampling errors are given. The relationship of these estimates to other methods of estimation which have been suggested is discussed.

621.391

418 A NONPARAMETRIC TECHNIQUE FOR THE DETECTION OF A CONSTANT SIGNAL IN ADDITIVE NOISE. J.Capon.

I.R.E. WESCON Convention Record, Vol. 3, Pt 4, 92-103 (1959).

The Neyman–Pearson optimum detection system uses a detector whose decisions depend on the probability density function (p.d.f.) of the noise and also on the fact that this can be completely specified by a finite number of parameters. However, if a pure noise waveform is available at the detector this can be compared with the observed waveform to determine the presence or absence of a signal by means of the Mann–Whitney test. This scheme remains valid even when the p.d.f. cannot be specified by a finite number of parameters and has clear advantages over the former method in which the detector is optimized for normal p.d.f's. and thus may be unsatisfactory for non-normal p.d.f's. G.D.Sims

621.391 : 621.372.6

ON THE OPTIMUM SYNTHESIS OF MULTIPOLE CONTROL SYSTEMS IN THE WEINER SENSE. See Abstr. 253

621.391

419 A PARADOX CONCERNING RATE OF INFORMATION. I.J.Good and K.Caj Doog.

Information and Control, Vol. 1, No. 2, 113-26 (May, 1958).

The Riemannian rate of information is defined and it is shown that for the case of time unlimited, band-limited, white noise, this rate becomes infinite. If the time series is considered to have a long but finite period the paradox is resolved i.e. the definition is satisfactory when used in conjunction with periodic band-limited white noise. The discussion refers to matrix signal/noise ratios and to the entropy of singular multivariate normal distributions. G.D.Sims

TELEGRAPH AND TELEPHONE SYSTEMS

621.394.324

420 PROPERTIES OF MODERN TELEPRINTERS WITH REGARD TO SIGNAL TRANSMISSION. H.Wusteney.

Trans Amer. Inst. Elect. Engrs I, Vol. 78, 362-7 (1959) = Commun. and Electronics, No. 44 (Sept., 1959).

The properties of a teleprinter with regard to signal transmission are determined by the performance of three functional units: the drive system, the transmitter and the receiver. The design and characteristics of a pageprinter recently developed are subjected to a theoretical examination and practical results are discussed. Results coming up very closely to the ideal values have been achieved with simple means.

621.394.324

421 REPERFORATOR-TELETYPEWRITER TT-195 ( )/FG. D.F.Frick.
Trans Amer. Inst. Elect. Engrs I, Vol. 78, 369-73 (1959) = Commun. and Electronics, No. 44 (Sept.,1959).

621.394.333

422 HIGH-SPEED TERMINAL PRINTERS. K.M.Kiel.
Elect. Engng, Vol.78, No.10, 1026-9 (Oct., 1959).

A description of high-speed (3000 words/min.)low-cost terminal printing equipment using the basic technique of electrostatic printing. Speeds of 30 000 words/min. are practicable with line feed on intermittent demand.

621.394.34

423 TELE-MAP. H.Hoffmann, Jr.
I.R.E. Nat. Convention Record, Vol. 6, Pt 8, 314-22 (1958).

Describes a system for reducing the redundancy of information in weather maps and converting it into a form suitable for teletype transmission. A compression of 64 to 1 in time–bandwidth product has been achieved. W.A.Cameron

621.395.5 : 681.142

THE APPLICATION OF A LARGE-SCALE ELECTRONIC COMPUTER TO THE ASSIGNMENT OF TELEPHONE FACILITIES. See Abstr. 592

621.395.5 : 621.395.74 : 621.317.34

A METHOD OF LOCATING DRY JOINTS IN TELECOMMUNICATION CABLES. See Abstr. 168

621.395.34

424 MECHANIZATION OF TOLL SWITCHING AT PROVIDENCE, R.I. C.W.Anderson and H.N.Thornton.
Trans Amer. Inst. Elect. Engrs I. Vol.77, 954-60 (1959) = Commun. and Electronics, No.40 (Jan., 1959).

Presents the mechanization at Providence as an object lesson in planning from the operating engineer's point of view. Providence is the capital of Rhode Island and also its largest city, and the island embraces a wide variety of trades and interests, as will as some military installations. A telephone history of the area is presented up to 1952, when a cost study was inaugurated to investigate toll mechanization for Providence, the results of which indicated the wisdom of replacing the toll office with a crossbar tandem equipped for centralized automatic message accounting (C.A.M.A.) operation. The organisation of a panel of Committees working on the details is discussed, and a broad outline is given of the changes in toll circuit setup undertaken. A figure shows the Rhode Island tandem trunking schematic, and there is some discussion of the various facilities provided, local and national, as well as of those planned for the future. W.J.Mitchell

TELEPHONE EQUIPMENT COMMUNICATION NETWORKS AND CABLES

621.395.64

425 REPEATERS IN LOCAL TELEPHONE NETWORKS AND P.A.B.X's. O.Hörner and W.Langsdorff.
Siemens Rev., Vol. 24, No. 7, 218-25 (Nov., 1959).

English translation of a paper already abstracted in Abstr. 1752 (1959).

621.395.665.1

426 A DISTORTIONLESS SYSTEM OF FEEDBACK TYPE INSTANTANEOUS COMPANDORS. T.Kasai.
J.Inst. Elect. Commun. Engrs Japan, Vol.42, No.7, 665-9 (July, 1959). In Japanese.

A distortionless instantaneous compandor system has previously been described by the author (See Abstr. 2199 of 1958) and is termed Type I. In a new compandor system, termed Type II, the compressor unit of the Type I equipment is substituted for the compressor normally fitted in a conventional negative-feedback type of compandor. The conditions for distortionless operation of this new arrangement are derived and possible causes of distortion in the practical circuit are discussed. A.Wilkinson

621.395.74

427 OPTIMUM METHODS FOR THE DESIGNING OF ROUTES AND NUMBER OF LINES IN TELEPHONE NETWORKS WITH ALTERNATIVE TRAFFIC ROUTES. I.Tänge.
Tele (English Edition), 1959, No. 2, 49-70.

English translation of a paper already abstracted in Abstr. 5880 (1957).

621.395.822

428 EVALUATING TOTAL TRUNK NOISE IN A MULTI-TRUNK COMMUNICATION SYSTEM. N.W.Feldman and G.P.Tripp.
I.R.E. WESCON Convention Record, Vol. 3, Pt 7, 41-3 (1959).

A simple equation is derived which relates the noise in a multi-trunk system to that in a single trunk. Use of the equation leads to a series of curves giving this increase in noise for nominal trunk losses ranging from 0 to 3 dB. A further series of curves show the degradation of system signal-to-noise ratio compared to that of a single 0 dB trunk. H.L.Nattrass

621.395.823

429 INTERFERENCE IN RAILWAY LINE-SIDE TELEPHONE CABLE CIRCUITS FROM 25 kV 50 c/s TRACTION SYSTEMS. A.Rosen.
Proc. Instn Rly Signal Engrs (1958), 55-79.

Deals with the theory of magnetic induction and methods of calculation, as well as with means of reducing interference. Screening by earthed conductors, particularly the cable sheath, is discussed together with dependence on the earthing resistance of the sheath and on the design of the cables, especially the use of armouring and describes the cables for the Manchester–Crewe line. Possibilities for reducing the interference at the source (booster transformers) are also mentioned. H.R.J.Klewe

ELECTROACOUSTIC APPARATUS

621.395.61

430 CALIBRATION OF MICROPHONES AT LOW FREQUENCIES. G.Berry.
Engineering (London), Vol. 188, 163 (Sept. 11, 1959).

The design principles of an acoustic duct which may be used to calibrate microphones in the frequency range 30 to 320 c/s are discussed. A procedure for comparing the sensitivities of two microphones is described, giving an indication of the accuracy that may be obtained.

621.395.62

431 DERIVED THREE CHANNEL PLAYBACK OF TWO-TRACK STEREO USING THREE MICROPHONES. P.W.Klipsch.
I.R.E. Nat. Convention Record, Vol. 7, Pt 7, 10-12 (1959).

It is common practice to use three microphones to feed a 2-track stereophonic system, the centre microphone feeding, either equally or unequally, into the inputs of the two flanking microphones. Such a system will have two reproducing amplifiers and loudspeakers but if, in addition, direct recovery of the centre channel from the two amplifier outputs is attempted, the result may be cancellation of this channel instead of faithful reproduction. This risk can be eliminated by the insertion of an all-pass phase-shifting network, with 90° phase-shift at about 1.7 kc/s, between one amplifier output and the centre loudspeaker. H.G.M.Spratt

621.395.623

432 THE DESIGN OF HIGH-QUALITY STEREOPHONIC GRAMOPHONE PICK-UPS FOR MINIMUM WEAR AND DISTORTION. D.G.Jaquess.
Proc. Instn Elect. Engrs [Convention on Stereophonic Sound Recording, Reproduction and Broadcasting] Part B Suppl. No. 14, 253-5 (1959).

Some of the factors which influence wear and distortion in disk reproduction are discussed. Reference is made to a mathematical analysis of these factors, which include continuity of contact between the stylus tip and the groove walls, and distortion due to longitudinal motion of the stylus. The analysis has been successfully applied without modification both to a wideband lateral pick-up for a 2-channel carrier system and to a pick-up for the present "complex-cut" system. A description of some of the practical aspects of design and manufacture is given.

621.395.625

433 SURVEY OF STEREOPHONY. T.Somerville.

Proc. Instn Elect. Engrs, Paper 3150E [Convention on Stereophonic Sound Recording, Reproduction and Broadcasting] publ. 1959 (Part B Suppl., No. 14, 201-8).

A comprehensive survey of techniques and systems.

621.395.625

434 RECENT DEVELOPMENTS IN STEREOPHONIC DISC RECORDING. J.G.Frayne and R.R.Davis.

Proc. Instn Elect. Engrs [Convention on Stereophonic Sound, Reproduction and Broadcasting] Part B Suppl. No. 14, 247-50 (1959).

The description is given of an analogue-computer analysis carried out to determine the cause of resonances in the upper high-frequency response of a disk cutter, and the mechanical modifications which were made in accordance with the solution suggested by the computer. The result is a smooth response up to at least 15 kc/s, which is verified by actual recordings. A description is also given of the design and application of an electromagnetic device which automatically controls the depth of the groove in accordance with the pitch. This is actuated from the pitch-control mechanism of the Scully recorder. There is also included a study of contemporary stereophonic disk pick-ups from the point of view of frequency response and crosstalk between tracks.

621.395.625.2

435 STEREOPHONY ON DISK. H.Redlich.

Elektron. Rdsch., Vol. 13, No. 8, 286-9 (Aug., 1959).

In German.

Possible methods for stereophonic recording on disks are reviewed. The two-component (Blumlein) system is then discussed and described in detail, with explanatory phasing diagrams and oscillograms. Pictures and diagrams are shown of a cutting stylus used (Teldec "ZS 45") and of a very light sapphire pick-up. Questions of quality distortion arising from various causes such as pinch effect, sapphire point curvature effect giving rise to second harmonics and groove distortion in the vertical direction due to the cutting process are discussed. The compatability of the signals in the two channels is considered. W.J.Mitchell

621.395.625.3

436 A VARIABLE-CYCLE ANNOUNCEMENT MACHINE. C.R.Keith.

Bell Lab. Record, Vol. 37, No. 9, 334-6 (Sept., 1959).

The announcement is stored on an elastic magnetic band mounted on a drum 9 in. in dia. and $3\frac{1}{2}$ in. wide, giving a spiral track of 100 ft in length. This track is followed by the record–replay head as the result of rotation of the drum combined with a traversing motion of the head. The latter is supported by a carriage which in turn is driven by a half-nut engaging with a feed screw cut on the drum spindle. The drum is friction-driven from a puck which is coupled to the driving motor by means of a belt. A switch assembly, pushed forward by the carriage during the original recording of the announcement, ensures that, in subsequent replays, the mechanism stops on completion of the announcement, regardless of its length. H.G.M.Spratt

621.395.625.3

437 MAGNETIC TAPE RECORDING. L.H.Bedford.

Electronic Radio Engr, Vol. 36, No. 9, 320-2 (Sept., 1959).

A novel graphical study of the mechanism of h.f. bias. A plot of the predicted waveform written on the tape as a result of the application of h.f. sinusoidal signals reveals equal alternate flats of opposite polarity. The superposition of an l.f. or d.c. signal results in: (1) similar flats of equal amplitude but unequal duration when the h.f. (bias) signal reaches saturation level or above; or (2) similar flats of unequal amplitude and duration when the h.f. signal does not reach saturation level. The validity of this exposition as an explanation of the working of h.f. bias is strengthened rather than otherwise by the fact that the recording of an l.f. signal without bias gave quite different results. H.G.M.Spratt

621.395.625.3

438 MAGNETIC RECORDING AND REPRODUCTION OF PULSES. D.F.Eldridge.

I.R.E. Nat. Convention Record, Vol. 7, Pt 9, 141-59 (1959).

A detailed analysis of the process for non-return-to-zero techniques. An expression is derived for the output of a playback head when an ideally recorded pulse is scanned. Both longitudinal and perpendicular components are considered but the perpendicular component is negligible. The width and height of the reproduced pulse are studied for varying gap width, coating thickness and head-to-coating spacing. The use of very small playback head gaps offers but little improvement in resolution. On the recording side, the shape and location of the recorded pulse are determined as functions of the magnetization characteristic, the gap width, coating thickness and separation. Generally, for an ideally recorded pulse, the reproduced pulse-width is about five times as great. Finally, to obliterate entirely the effects of previous recordings the recording current should be twice that required for saturation. H.G.M.Spratt

621.395.625.3 : 681.142

439 A NEW AIRBORNE [MAGNETIC-TAPE] DATA RECORDER. P.N.A.Veenhuyzen.

I.R.E. WESCON Convention Record, Vol. 3, Pt 5, 41-51 (1959).

An airborne magnetic tape recorder capable of recording the radar indicator attack display, along with other pertinent information including audio is described. The equipment will accept simultaneously 22 independent variable-value inputs, 42 independent two-valued inputs, and an audio signal. The variable-value inputs may be signals of any voltage range, within the frequency band of 0 to 3 c/s. The inputs may alternatively be in the form of a.m. suppressed-carrier signals with modulation frequencies from 0 to 3 c/s and carrier frequencies to 2 kc/s. The inputs are multiplexed by the airborne equipment, digitally converted, and recorded as 7-bit binary numbers. Each variable-value input is sampled and recorded 15 times per second and each two-valued input $7\frac{1}{2}$ times per second. Recording capacity of the equipment is 2 hr. The recorder is packaged in a single unit $13\frac{1}{2} \times 9\frac{5}{16} \times 15$ inch in outside dimensions, and weighs approximately 40 pounds. Operation is entirely automatic; no controls are required. The ground-based reproducing equipment reconverts the recorded binary-form information to its original analogue form for use in recreating a visual display. If desired, the digitized data may be extracted from the tape for further data processing.

621.395.625.3

440 MAGNETIC RECORDING OF PULSES. L.V.Petrov.

Priborostroenie, 1959, No. 5, 10-12 (May). In Russian. English translation in: Instrum. Constr., 1959, No. 5, 10-12 (May).

A combined mathematical and graphical method of analysis enables the reproduced waveform resulting from pulse recording of the non-return-to-zero type to be determined. It is pointed out that pulse density can be increased by so designing the recording head that the field drops rapidly each side of the gap. Basic circuits for producing phase-modulated and time-modulated pulses are briefly described. H.G.M.Spratt

621.395.625.3

441 ENDLESS LOOP MAGNETIC TAPE TREE. S.W.Liddle.

J. Audio Engng Soc., Vol. 7, No. 2, 89-91, 96 (April, 1959).

This loop assembly is required for rapid transcription from a master to slave tapes. The master is 1250 ft long and $\frac{1}{2}$ in. wide. The assembly consists of 95 pulleys arranged in two horizontal banks, one located about 13 ft above the other. The tape is threaded up and down from one end of the assembly to the other and through the tape transport to form an endless loop. The pulleys are stationary but the tape floats over them on a film of air which is supplied through small orifices around the circumference. The air pressure can vary from 30 to 50 lb/in^2. It is found that the tape will run smoothly without tension over these pulleys or "air idlers". Provision for removing static charges has to be made. H.G.M.Spratt

621.395.625.3

442 MAGNETIC DRUM TIME COMPRESSION RECORDER. W.R.Chynoweth and R.M.Page.

I.R.E. Nat. Convention Record, Vol. 7, Pt 4, 242-51 (1959).

The recorder has a time compression ratio of 82 800 : 1 and is capable of a record-playback bandwidth of 100 kc/s to 7.5 Mc/s using either pulse bias or d.c. bias recording. Air-bearing techniques are used to support the record and playback heads within 200 μin. from the drum surface, which is sufficiently close to resolve a 0.001 inch recorded wavelength. The frequency response is flat within ±2 dB over the operating bandwidth. At a 30 mA record level, the signal-to-full-bandwidth-r.m.s.-noise is 20 dB. Present indications are that the life of the drum surface and the heads is indefinitely long when properly adjusted.

RADIOCOMMUNICATION

621.396 : 621.391.821 : 621.317.34

443 THE MEASUREMENT OF ATMOSPHERIC RADIO NOISE BY AN AURAL COMPARISON METHOD IN THE RANGE 15-500 kc/s. J.Harwood and B.N.Harden.
Proc. Instn Elect. Engrs, Paper 3115 E, publ. Jan., 1950 (Vol. 107 B, 39-52).

Atmospheric noise received on a vertical aerial is compared with a locally-generated keyed signal to estimate the level at which the signal is 95% intelligible. This method was used in earlier high-frequency equipment and has been adapted for the range 15-500 kc/s. The apparatus and its method of operation are described. Results obtained at a number of sites are discussed in relation to more objective measurements. In particular, deduced noise powers are compared with existing world-wide predictions, revealing some differences.

621.396.2 : 621.396.65 : 621.372.8

AN INTRODUCTION TO WAVEGUIDES AND MICROWAVE RADIO SYSTEMS. See Abstr. 255

621.396.2

444 A WORLD-WIDE HIGH FREQUENCY SINGLE SIDEBAND RADIO NETWORK. E.Bray.
I.R.E. Nat. Convention Record, Vol. 6, Pt 8, 245-53 (1958).

It is shown that, utilizing only moderate transmitter powers, a very reliable h.f. communication system, with predictable performance, can be designed by proper choice of equipment, aerial system, operating frequencies and facilities, and by utilization of the best available circuits through radio relaying. The requirements of and the engineering approach to such a system are outlined.

A.Reiss

621.396.2 : 621.396.65

445 THE EXPANSION OF THE PACIFIC COAST MICROWAVE NETWORK. R.G.Kuck.
Trans Amer. Inst. Elect. Engrs I, Vol. 77, 898-903 (1959) = Commun. and Electronics, No. 40 (Jan., 1959).

A short historical review of the network is given. The present system and some of the equipment used is discussed in general and comments are made on possible future expansions. A few of the more interesting problems solved by means of microwave links are described.

H.L.Nattrass

621.396.33

446 PHASE-SHIFT KEYING IN FADING CHANNELS. H.B.Voelcker.
Proc. Instn Elect. Engrs, Paper 3125 E, publ. Jan., 1960 (Vol. 107 B, 31-8).

Phase-shift keying (p.s.k.) is discussed as a modulation technique for transmitting digital data over radio circuits subject to fading. The modest bandwidth requirements of p.s.k. modulation suggest that it can not only alleviate spectrum crowding, but can also transmit traffic with fewer errors. The theoretical results presented here indicate, however, that the random phase perturbations inherent in fading radio signals cause unavoidable degradation in the performance of p.s.k. systems. Experimental data which partially support the theoretical results are cited, and comments relevant to the improvement of p.s.k. systems are included.

621.396.34

447 AUTOMATIC ERROR DISCRIMINATION AND CORRECTION IN RADIO TELETYPE SYSTEMS. W.J.Griffiths.
Proc. Instn Radio Engrs Australia. Vol. 20, No. 10, 591-600 (Oct., 1959).

The efficiency and reliability of automatic teletype systems may be improved by the electrical recognition of an error at the time of reception followed by repetition of the mutilated signal. Error detection is based either upon special codes or the rejection of signals falling below a certain threshold. The operation of two equipments based upon these systems is described.

621.396.41 : 621.396.97

448 V.H.F. TRANSMISSION OF STEREOPHONIC PROGRAMMES. J.J.Geluk.
Proc. Instn Elect. Engrs, Paper 3153E [Convention on Stereophonic Sound Recording, Reproduction and Broadcasting] publ. 1959 (Part B Suppl. No. 14, 239-44).

Consideration is given to the v.h.f. transmission of stereophonic programmes, restricted to f.m. transmitters with a sub-carrier system. Criteria are given, indicating the superiority of the so-called double f.m. system, which has a much smaller deviation than usual of the main carrier due to the sub-carrier, the deviation of which is reduced to only 15 kc/s. A circuit description is given of both the transmitter duplexer and the adaptor necessary for ordinary f.m. receivers. Special attention has been paid to applications of sub-carrier systems other than for stereophony. These lead to more stringent requirements for the crosstalk attenuation.

621.396.43

449 BASIC ANALYSIS ON CONTROLLED CARRIER OPERATION OF TROPOSPHERIC SCATTER COMMUNICATION SYSTEMS. L.P.Yeh.
I.R.E. Nat. Convention Record, Vol. 6, Pt 8, 261-83 (1958).

In order to obtain the desired reliability of such systems, it is customary to maintain the transmitter r.f. power at the maximum level. The average power is thus much higher than is actually needed and the interference area is considerably extended during the periods of improved propagation conditions. The most promising solution of this problem is to control the transmitter r.f. power so that it changes as closely as possible in accordance with the fluctuation of the level of the received signal. The present paper deals with the first part of a study programme, the other three parts being concerned with (a) the saving in average transmitter power and reduction of interference, (b) the control system in the form of a closed servo loop, (c) the method of controlling the transmitter r.f. output. The analysis indicates that controlled-carrier operation is feasible if certain basic requirements can be met. It is noted that the sampling period of fast fading with the Rayliegh distribution is preferably one minute. For slow fading, the long-term median distributions on a minute basis should give a much better representation of the actual conditions than the conventional long-term hourly median distributions. The instantaneous signal distribution may either be obtained from the probability combination of the fast-fading and slow-fading distributions or by actual experiments. The control system must be capable of excluding the aircraft effect, in connection with which the time constant of the signal sensing circuit is of extreme importance. In order to respond to a fading rate of 10 c/s, the time constant should be about 0.015 sec. 24 references.

A.Wilkinson

621.396.43

450 TRANSMISSION OF DIGITAL DATA OVER MULTIHOP TROPOSPHERIC SCATTER CIRCUITS. C.N.Lawrence.
I.R.E. Nat. Convention Record, Vol. 6, Pt 8, 292-7 (1958).

Although there is relatively little available information at present on scatter-circuit transmission of digital data at speeds higher than that of conventional teletype, there is evidence that with some refinement of techniques already known, excellent results can be expected. Primary attention should be directed to the improvement of diversity radio circuit arrangements and also to the use of more elegant means of packaging binary digital information in order to make maximum use of the bandwidths available. Some directions of technical approach to the problems involved are indicated.

A.Wilkinson

621.396.43

451 THE DESIGN OF WIDEBAND SCATTER SYSTEMS. M.O.Felix.
I.R.E. WESCON Convention Record, Vol. 3, Pt 7, 33-40 (1959).

The design of wideband scatter systems is discussed with particular reference to choice of carrier frequency, i.f. amplifiers, diversity receiver combining, and differential delay correction. It is shown that random phase modulation, due to variable group delay in the scatter path, is proportional to modulation frequency and aerial beamwidth. For a given aerial size, beamwidth varies inversely with frequency, hence for a given link, maximum modulation frequency is proportional to carrier frequency. Thus wideband links should use the highest possible carrier frequency. It is also shown that a distortionless f.m. system must have both a flat constant-delay i.f. and a flat constant-delay baseband. Two ways of approaching the best i.f. amplifier design are discussed. Two means of combining are considered; i.f. combining and baseband combining. A delay correction system is described which has a loop gain of 20 thus reducing a 100mμs delay to a 5mμs delay at the combiner input.

H.L.Nattrass

621.396.43

452 THE NEW SOUTH WALES NORTH COAST TRUNK RADIO NETWORK. J.D.Thomson and B.W.G.Penhall.
Proc. Instn Radio Engrs Australia, Vol. 20, No. 10, 601-11 (Oct., 1959).

The heavy 1955 floods had a calamitous effect on trunk communications in the New South Wales North Coast area. Because of its nature, a radio network would have continued working under similar circumstances and the plan for the use of such a network is described in three main categories: (1) single channel trunks; (2) small capacity multi-channel bearer systems; and (3) large capacity multi-channel bearer systems. Some of the problems involved in the planning of such an extensive network are detailed together with the proposals for their solution.

621.396.44

453 A COMPRESSED-BANDWIDTH STEREOPHONIC SYSTEM FOR RADIO TRANSMISSION. W.S.Percival.
Proc. Instn Elect. Engrs, Paper 3152 E [Convention on Stereophonic Sound Recording, Reproduction and Broadcasting] publ. 1959 (Part B Suppl. No. 14, 234-8).

The purpose of the system is to provide a stereophonic signal for radio transmission within a bandwidth only slightly greater than that required for ordinary monophonic transmission. The left and right microphone signals are combined to form a single a.f. signal which is available for ordinary monophonic reception. They are also processed in such a way as to emphasize the beginnings of sounds and then utilized to form a signal, with a bandwidth of 100 c/s, carrying the directional information only. This directional signal is caused to modulate a sub-carrier at a power level much lower than that of the a.f. signal. In the receiver the a.f. signal and the directional signal are applied to a Hall multiplier unit giving the required left-loudspeaker signal as one output and the right-loudspeaker signal as the other.

TRANSMITTERS . RECEIVERS

621.396.61/.62

454 MOBILE RADIO SYSTEM HAS 3000-MILE RANGE. W.Harnack.
Electronics, Vol. 32, No. 35, 44-7 (Aug. 28, 1959).

A description of a new twin-single-sideband 10 kW transmitter and receiver equipment in the 4 to 28 Mc/s band contained in two vans, one for the transmitter and the other for the receiver-communications centre, designed to link field commanders with (American) Army's global radio network. The 6 kc/s upper and lower side-bands are split into two 3 kc/s channels providing four channels for voice or teletypewriter. One 3 kc/s channel can accommodate 16 teletypewriter channels. Information between the two vans, normally spaced 2 to 10 miles apart is carried on a u.h.f. link at about 900 Mc/s. A set of block diagrams is given.

J.W.Lee

621.396.61/.62

455 TRANSPORTABLE TROPOSPHERIC SCATTER COMMUNICATION SYSTEMS.
A.J.Svien and J.C.Domingue.
I.R.E. Nat. Convention Record, Vol. 6, Pt 8, 284-90 (1958).

Describes two types of Collins terminal equipment. The TST-101 transmitting and receiving equipment is mounted in a 30 ft van with an associated flat-bed trailer and generator. The aerials, 15 ft metal paraboloids, are dismantled and mounted on the trailer for transport. The AST-101 equipment is contained in two shelters, of inside dimensions 76 in. × 76 in. × 96 in., and is used with 15 ft inflatable aerials mounted on the shelter roofs. The aerials are stowed within the shelters for transportation. If required, the shelters can be transported on standard 2½ ton military vehicles, though primarily designed for air transport. The performance is the same for both types of equipment, which operate in the range 755-985 Mc/s. Tests carried out over circuits of lengths from 25 to 150 miles showed that highly reliable communications could in all cases be established. Arrangements are provided for operation of both transmitter and receiver on a single aerial, and an additional receiver and aerial permits diversity reception. The f.m. exciter unit can handle from 4 to 24 voice channels. Tests over a circuit of length about 100 miles showed that at the full output of 1 kW the teletype error rate was $< 0.01\%$. Analysis indicates that operation at frequencies around 2000 Mc/s may give improved performance.

A.Wilkinson

621.396.61/.62

456 PROBLEMS PECULIAR TO SINGLE SIDEBAND TRANSMITTING EQUIPMENT. K.Gilabert.
Onde elect., Vol. 39, 715-22 (Sept., 1959). In French.

It has been established that the low frequency spectrum need only be re-established, in reception, with an accuracy of 30-40 c/s for adequate intelligibility of speech. This involves frequency stabilities of 10^{-8} at 30 Mc/s, which can easily be achieved if quartz controlled oscillators with trimmers for small corrections are used. Some commercial transmitter–receivers are described.

W.G.Stripp

621.396.616

457 HOW TO CONSTRUCT A MINIATURE F-M TRANSMITTER. D.E.Thomas and J.M.Klein.
Electronics, Vol. 32, No. 31, 80-1 (July 31, 1959).

A single transistor acts as oscillator, modulator and audio amplifier. A Hartley-type circuit is used and frequency modulation is obtained by the feedback-loop phase shift resulting from alpha cut-off frequency shift controlled by the audio input, which is applied to the base. All components, including a microphone, are mounted on a $2\frac{1}{2}$ in. by $1\frac{1}{2}$ in. panel and the transmitter can be held in the hand. With the small rod aerial used, the range is 200 ft. Details of construction are given.

W.G.Stripp

621.396.62

458 TRANSISTORIZING AUTOMOBILE BROADCAST RECEIVERS. R.A.Santilli and C.F.Wheatley.
Electronics, Vol. 32, No. 38, 42-5 (Sept. 18, 1959).

A full engineering description of a transistorized car radio is given, distinguished by a performance identical in every respect with that of a valve receiver, and by the fact that only 5 transistors are used. This is made possible by the choice of 3 high-gain drift transistors as r.f. stage, oscillator-mixer and i.f. amplifier. Problems of mixer stages, particularly those of blocking on strong local signals, are singled out for special attention.

A.Landman

621.396.62 : 621.385.633

459 APPLICATION OF A BACKWARD-WAVE AMPLIFIER TO MICROWAVE AUTODYNE RECEPTION. J.K.Pulfer.
I.R.E. Trans Microwave Theory and Tech., Vol. MTT-7, No. 3, 365-9 (July, 1959).

A microwave receiver using a single-circuit backward-wave amplifier as a combination r.f. amplifier and homodyne local oscillator is described. The amplifier tube is operated at a value of beam current just above that required to maintain oscillation. It is shown that in this way, the high gain and narrow bandwidth of the single-circuit b.w.t. may be utilized in an electronically tunable microwave receiver. The resultant sensitivity is 10 to 15 dB worse than that obtainable from a good superheterodyne. The loss in sensitivity is due entirely to the high noise figure of the tube, which can theoretically be reduced to a value comparable with that of a superheterodyne. The advantages of the receiver are its simplicity and its lack of image difficulties. Rejection of off-frequency signals is such that they are attenuated by at least 50 dB.

621.396.621.54

460 THE F.M. MULTIPLEX STEREO RECEIVER. H.N.Parker.
I.R.E. WESCON Convention Record, Vol. 3, Pt 7, 28-32 (1959).

Receiver specification up to and including the demodulator stage is considered in the light of recent American developments in multiplex f.m. broadcasting. Two classes of receiver are treated: a simpler set catering for the main channel and a single stereo. sub-channel, and a more complex one, coping with two subcarriers, where the second sub-channel might have to be eliminated from the receiver output. Demands on i.f. amplifier bandwidth and phase fidelity are discussed, and various methods of subcarrier selection and/or suppression and of demodulation are considered. Circuit methods include balanced mixers, double superhets and pulse counting detectors suitable for a low second i.f.

A.Landman

RADIOFREQUENCY EQUIPMENT

621.396.662

461 RADAR CRYSTAL VALVES. A.Lindell and T.Oxley.
Proc.Instn Elect. Engrs, Paper 3104E [International Convention on Transistors and Associated Semiconductor Devices], publ. 1960 (Part B Suppl. No.15, 426-33).

A brief historical survey is made of the use of semiconductor devices as frequency changers or mixers in radar applications, with

particular reference to factors that led to the design and performance of the types CV2154-5 silicon mixer crystals. The factors that led to the choice of a coaxial construction and the part played by the insulator and its effect on admittance is discussed. A mixer crystal incorporating a germanium wafer and titanium whisker is described. This crystal has a noise factor better by 2 dB than the silicon and tungsten combination of the types CV2154-5. The necessity for positive bias, its effects on r.f. admittance and noise factor and methods of obtaining the bias when required are considered. The superior bandwidth and small spread in admittance between samples is attributed to the choice of material for the insulator. Burn-out performance is discussed and measurement of this parameter indicated. Finally, it is shown that, contrary to general belief, the behaviour of germanium mixer crystals as a function of temperature is not significantly different from silicon devices, at least over the temperature range −80 to + 100°C.

621.396.662.1 : 621.382.23

462 CIRCUIT DESIGN USING SILICON CAPACITORS. J.Hammerslag.
Electronics, Vol. 32, No. 38, 48-50 (Sept. 18, 1959).

An elementary outline of the properties of capacitors formed by reverse-biased silicon junction diodes, and of their applications in remote tuning and a.f.c. in radio receivers. F.F.Roberts

AERIALS

621.396.67

463 APPLICATION OF KOTEL'NIKOV'S THEOREM TO THE THEORY OF AERIALS. V.P.Peresada.
Radiotekhnika, Vol. 14, No. 8, 71-4 (Aug., 1959). In Russian.

The theorem is used in the calculation of efficiency of aerials having uniform aperture distribution. The amplitude and phase of the field is measured at fixed points across the aperture and, by means of a deduced relation, it is possible to calculate, without integration, the useful reflecting area of the aerial. The method is particularly suitable in the experimental determination of aerial parameters of large aperture: moreover, with discrete measurements it is possible to define uniquely the radiation characteristics of the aerial. Z.F.Voyner

621.396.67

464 TEMPERATURE OF A SPUTNIK ANTENNA. H.Schenck, Jr.
Amer. J. Phys., Vol. 27, No. 7, 523-4 (Oct., 1959).

The thermal behaviour of a thin rod of constant thermal conductivity, emissivity and cross-section, for which the convective and radiant heat losses are proportional to the first and fourth powers respectively, is treated mathematically. It is shown that the total heat loss to the surrounding void is proportional to the 5/2 power of the root temperature. S.Weintroub

621.396.67

465 THE DESIGN CRITERIA OF A COMMON AERIAL SYSTEM FOR SIMULTANEOUS TRANSMISSION AND RECEPTION OF V.H.F. SIGNALS. J.K.Grierson.
Electronic Engng, Vol. 31, 546-9 (Sept., 1959).

A common aerial system that consists of five sections is described. The sections are a transmitter, a transmission coupling network, a receiver, a reception coupling network and an aerial. The transmission and reception coupling networks enable a single aerial to be used for transmission and reception of frequency-spaced signals without the necessity of time sharing. The coupling networks are considered in detail and practical values of components are assigned.

621.396.67

466 SWITCHING V.H.F. POWER WITH SILICON DIODES. R.H.Mattson and S.H.Liu.
Electronics, Vol. 32, No. 25, 58-9 (June 19, 1959).

A diode switching system is described which can be used to connect a radio transmitter and receiver in an aircraft to either of two aerials. The diodes are alternately made conducting or biased-off by a square-wave voltage. Details are given of a small and simple design in which the diode is mounted within a coaxial T-connector. W.T.Blackband

621.396.676

467 OPTIMIZING ANTENNA SWITCHES AND PHASERS. I.Diugatch.
Electronics, Vol. 32, No. 33, 55-7 (Aug. 14, 1959).

It is not possible to fit a single omnidirectional aerial to an aircraft, but two aerials can be arranged which between them cover all directions. In order to avoid mutual interference when both are operated in parallel a switch may be used to select the stronger signal, or a phase-changer be used in order to bring the two signals into phase. An electronic control system for automatically achieving this adjustment is described. W.T.Blackband

621.396.677.71 : 621.372.826

ANNULAR-SLOT LAUNCHERS FOR SINGLE-CONDUCTOR TRANSMISSION LINES. See Abstr.275

621.396.677.73

468 A STUDY ON ANTENNAE FOR MILLIMETRE-WAVE GRATING SPECTROMETER. T.Sueta.
J. Inst. Elect. Commun. Engrs Japan, Vol. 42, No. 7, 677-83 (July, 1959). In Japanese.

In analogy with optical instruments, various experimental arrangements were investigated in order to obtain design data. In all cases a pulsed magnetron operating on a wavelength of 6.7 mm was used as a generator. In the first experiments, small electromagnetic horns were used as the transmitting and receiving aerialss of an echelette-grating spectrometer. The received-signal pattern was obtained by rotating the grating about its axis. The half-power width of this pattern is inversely proportional to the resolving power, which in this case is less than the ideal value on account of the spherical phase-front of the horns. Phase errors were investigated and the resolving power in the presence of second-order phase errors was calculated by simple theory. In the second part of the work, the operation of a large-aperture paraboloidal aerial as the receiving aerial of a grating spectrometer was studied, a small horn at a great distance being used as the transmitting aerial. Measurement of the axial amplitude distribution in the Fresnel region of the paraboloid showed a definite Fresnel pattern. Although this amplitude distribution exhibits remarkable variations, the characteristics of a spectrometer which uses such an aerial do not show appreciable variations. This is explained by the assumption that in the Fresnel region of a large-aperture aerial the phase front deviates from a phase wave by no more than a few tens of degrees. Finally, the grating spectrometer as a wavelength measuring instrument was studied. It is found that the degree of dispersion of a grating spectrometer in terms of relative wavelength variation, i.e., $d\theta/(d\lambda/\lambda)$, is almost independent of the frequency range, so that the error in the measurement of the angle of rotation determines the relative error of wavelength measurement. On the other hand, in the case of the cavity resonator or the optical-analogue interferometer, the error in length measurement corresponds not to $d\lambda/\lambda$, but to $d\lambda$ itself, so that at the shorter wavelengths the use of the grating spectrometer becomes preferable. A.Wilkinson

621.396.679.4

469 STRIP TRANSMISSION LINE CORPORATE FEED STRUCTURES FOR ANTENNA ARRAYS. D.Alstadter and E.O.Houseman, Jr.
I.R.E. Nat. Convention Record, Vol. 7, Pt 3, 113-25 (1959).

Power dividers suitable for feeding many aerial elements from a single feed can be made from strip transmission line. Curves show the proportioning of such lines in order to achieve a given characteristic impedance. The design of multiple stepped transformer sections is simplified by the use of curves which relate the minimum number of sections to the bandwidth requirements. Information is given about typical systems of up to 48 elements working over the band 1.4 to 2.7 kMc/s. W.T.Blackband

PROPAGATION . INTERFERENCE

621.396.8

470 THE DAILY COURSE OF THE BACK-SCATTER FIELD STRENGTH OF TELEGRAPHY SIGNALS. B.Beckmann and K.Vogt.
Nachrichtentech. Z. (N.T.Z.), Vol. 12, No. 8, 419-20 (Aug., 1959). In German.

Continuing previous work (see Abstr. 1194 of 1956 and 2345 of 1957), a description is given of observations of the daily changes of the back-scatter field strength of short-wave telegraphy signals. The ring method was used to display the amplitude of the signals as circles on the c.r.o. screen. Typical oscillograms obtained at intervals throughout the period 9.30 to 21.30 C.E.T. are shown.

Continuous records of the field strength of WWV 25 Mc/s signals at Darmstadt during the same period are also shown. These indicate that back-scatter first occurs about 10.15 C.E.T., about 2 hours before the rise of the WWV signals. After the initial increase of the back-scatter amplitude, the effect of midday damping is seen, the back-scatter rings being smaller around 12.30 hrs. Towards 16.00 hrs. in consequence of the decreased damping, double jumps are shown by the presence of 2 back-scatter rings of increasing diameter. In the evening the back-scatter fields fade away at about 21.20 C.E.T., at which time the 25 Mc/s WWV signals also fade. A.Wilkinson

621.396.8

471 A REVIEW OF LONG DISTANCE RADIO COMMUNICATION. O.L.Wirsu.

Proc. Instn Radio Engrs Australia, Vol. 20, No. 10, 575-81 (Oct., 1959).

A general review is given of (a) the methods adopted to improve the performance of the older communication methods, viz. single sideband operation, automatic error correction, bandwidth restriction and rhombic aerials and (b) the new communications systems using scatter propagation, waveguide transmission, repeatered submarine cables and satellite relay transmission.

621.396.8

472 TROPOSPHERIC SCATTER PROPAGATION CHARACTERISTICS. A.J.Svien and J.C.Dominque.

I.R.E. Nat. Convention Record, Vol. 7, Pt 1, 3-9 (1959).

Describes tests carried out in Arizona and New Mexico at frequencies of 810, 880 and 950 Mc/s on tropospheric circuits ranging from 50 to 385 miles, to investigate the effects of aerial height and of elevated horizons. The results obtained are presented graphically and discussed in detail, with particular reference to the results of Booker and Gordon (see Abstr. 6366 of 1957) and of Norton, Rice and Vogler (see Abstr. 1568 of 1956). A.Wilkinson

621.396.8

473 ERRORS IN IONOSPHERIC FORECASTING. CRITICAL FREQUENCIES FOR THE E AND F_2 LAYERS.

C.M.Minnis and G.H.Bazzard.

Electronic Radio Engr, Vol. 36, No. 10, 380-3 (Oct., 1959).

The error in forecasting the m.u.f. for a point-to-point circuit consists of two parts: (a) the error in forecasting solar activity and the corresponding vertical-incidence critical frequency or m.u.f. factor; (b) the error in calculating the m.u.f. for a given set of conditions in the ionosphere. Only (a) can be considered as a true forecasting error. A sample of the errors made in forecasting f_0F_2 for a number of ionospheric observatories during the years 1949-1957 has been examined. It is concluded that a typical value for the standard deviation of the error is 15% for a location for which adequate ionospheric data is available. Mean errors of about 5% may occur for limited samples of the data. The standard deviation of the error in forecasting f_0E was found to be 5.5% for the years 1947-1957 with a mean error of less than 1%.

621.396.812.3 : 538.56

474 A NOTE ON THE STATISTICAL THEORY OF RADIO-WAVE PROPAGATION OVER AN IDEALLY CONDUCTING PLANE. É.A.Kaner and F.G.Bass.

Dokl. Akad. Nauk SSSR, Vol. 127, No. 4, 792-5 (Aug. 1, 1959). In Russian.

Assumes a propagation medium with small chance fluctuations $\delta\epsilon$ of the dielectric constant $\epsilon = \langle\epsilon\rangle + \delta\epsilon$, where $\langle\epsilon\rangle$ and $\langle\delta\epsilon^2\rangle$ are assumed independent of time and the coordinates. The source is a dipole situated above the boundary plane. Only large scale fluctuations are considered, i.e. where the characteristic correlation radius is large compared with the wave-length. Starting from Maxwell's equation, the presence of the boundary is shown to lead to a sharp increase in the relative fluctuations as compared with the case of an infinite medium; these increases occur near the interference minima of the regular field component. The cases of a curved and a finitely conducting boundary are also discussed. D.E.Brown

621.396.812.3

475 ANALYZING MULTIPATH DELAY IN COMMUNICATIONS STUDIES. J.F.Lyons, Jr.

Electronics, Vol. 32, No. 36, 52-5 (Sept. 4, 1959).

Ionospheric conditions may be studied by analysing the relative phase and amplitude of the multipath r.f. signals received in a communications link. Phase measurement is reduced to time measurement by pulse transmission and the two classes of signal expected are composite waveforms for pulses longer than the multipath delay time and discrete waveforms for pulses shorter than the delay time. Equipment is described which triggers at appreciable changes in the relative amplitude of the received waveform and prints out the amplitudes and delay times between triggerings. The analyser capacity is limited to the measurement of four time intervals per pulse and the digital-recorder printing mechanism limits the sampling rate to five pulses per second. H.L.Nattrass

621.396.812.3

476 SOME RELATIONS BETWEEN THE BEARING AND AMPLITUDE OF A FADING RADIO WAVE.

H.A.Whale and L.M.Delves.

J. atmos. terrest. Phys., Vol. 13, No. 1-2, 72-85 (1958).

A correlation ratio connecting the changes in amplitude with the changes of bearing of a fading radio wave made up of a number of randomly phased components is derived. The modifications necessary when specular components are also present are indicated. Experimental measurements of the correlation ratio for waves reflected from the ionosphere are compared with the theory.

621.396.812.4

477 EQUATORIAL SUNSET EFFECT. A.M.Humby.

Wireless Wld, Vol. 65, No. 7-8, 343-5 (July-Aug., 1959).

Several examples are given of a propagation anomaly associated with communication links having terminals in equatorial areas. During years of high solar activity it has been found that for equinox months there is marked azimuthal scattering of signals for about two hours near local sunset at the equatorial terminal, making communication extremely difficult. It seems probable that this effect is related to the disintegration of the F2 layer observed at Singapore near local sunset during equinox months [B.W.Osborne, J. Brit. Instn Radio Engrs, Vol. 12 (Feb. 1952)]. G.M.Brown

621.396.812.5 : 538.56

478 LONG-PATH V.L.F.—FREQUENCY VARIATIONS ASSOCIATED WITH THE SOLAR FLARE OF 23 FEBRUARY 1956. A.H.Allan, D.D.Crombie and W.A.Penton.

J. atmos. terrest. Phys., Vol. 10, No. 2, 110-13 (1957).

The frequency and phase variations of GBR on 16 kc/s as received in New Zealand during the solar flare of 23 February 1956 are described and compared with the effects during a normal flare. The difference is attributed to the cosmic-ray increase accompanying the 23 February flare.

621.396.82

479 INTERCHANNEL INTERFERENCE IN F.M. AND P.M. SYSTEMS UNDER NOISE LOADING CONDITION.

M.Kuwabara.

J. Inst. Elect. Commun. Engrs Japan, Vol. 42, No. 7, 689-96 (July, 1959). In Japanese.

Fourier analysis is applied to derive formulae for the interchannel interference in such systems due to the amplitude and phase characteristics of the transmission system. The results obtained for the ratios of signal to second- and third-order crossmodulation noise coincide with those given by Rice (see Abstr. 5915 of 1957). From the fundamental formulae, the discussion is extended to the characteristics which can be expanded in power series of the frequency, and also to echo distortion. As an example, calculations are carried out for double-humped amplitude and delay characteristics such as frequently occur in wideband transmission systems. A.Wilkinson

621.396.821

480 PRECIPITATION STATIC AT HIGH ALTITUDES. L.A.Hartman, F.B.Pogust and S.Gitelson.

I.R.E. Nat. Convention Record, Vol. 7, Pt 8, 114-17 (1959).

A flight study was made of precipitation static using an F-86 L aircraft. The streamer type of discharge across a dielectric surface was the most prevalent source of noise. This was most violent in cumulonimbus, but was noticeable in cirrus clouds in which the effect was most marked at about 35 000 ft. The effects of airspeed on discharge were studied. W.T.Blackband

621.396.822

481 STANDARD MEASUREMENT PARAMETERS FOR PHENONEMA [PHENOMENA] DISTRIBUTED IN TIME AND FREQUENCY. E.W.Chapin.

I.R.E. Nat. Convention Record, Vol. 7, Pt 8, 60-3 (1959).

A short history and list of r.f. noise measurement specifications is given together with a brief statement of the problem of measuring

non-sinusoidal noise phenomena such as ignition interference. A set of time-constant and bandwidth parameters is suggested as suitable measurement parameters. H.L.Nattraas

621.396.823 : 621.315.62

482 RADIO INTERFERENCE FROM H.V. INSULATORS. C.H.W.Clark

Elect. Rev., Vol. 165, No. 11, 491-7 (Oct. 23, 1959).

Explains the mechanism of interference generation by high-voltage insulators and the effect of insulator design on radio interference. The measurement of interference is considered and methods of overcoming the difficulties involved are discussed.

621.396.824

483 VARIATIONS IN THE DIRECTION OF ARRIVAL OF HIGH-FREQUENCY RADIO WAVES. J.E.Titheridge.

J. atmos. terrest. Phys., Vol. 13, No. 1-2, 17-25 (1958).

A general relation is derived for determining the effect of a non-horizontally uniform ionosphere on the propagation of short radio waves. The deviations for linear and parabolic layers are evaluated and the results generalized to include an ionosphere with several layers. Some experimental results showing large diurnal changes in apparent bearing are discussed and shown to be consistent with the foregoing theory.

RADIO APPLICATIONS . RADAR

621.396.933

484 THE DESIGN AND CONSTRUCTION OF GROUND-BASED NAVIGATIONAL AIDS AND THEIR EFFECT ON MAINTENANCE. M.Cassidy.

Proc. Instn Radio Engrs Australia, Vol. 20, No. 10, 612-21 (Oct., 1959).

A brief description is given of the geographical distribution of the radio navigational aids operated by the Australian Department of Civil Aviation and the associated organisation required to deal with the problem of maintaining a large network of stations, many of which are remotely located. The aim of the maintenance organisation is to meet reliability standards, which have been determined on the basis of civil aviation operational requirements tempered by physical practicability. In this environment, the design and construction of electronic equipment are major factors affecting reliability, and the salient features are discussed. It is concluded that the foundations of efficient maintenance are laid in the design and production stages of new equipment.

621.396.933.1

485 MEETING A.G.R.E.E. RELIABILITY REQUIREMENTS FOR AIRBORNE TACAN EQUIPMENT.

A.L.Floyd and H.G.Romig.

I.R.E. WESCON Convention Record, Vol. 3, Pt 6, 46-57 (1959).

The Advisory Group on Reliability of Electronic Equipment (A.G.R.E.E.) laid down a mean time between failures of 150 hr for airborne Tacan equipment and called for development of means of raising a low predicted m.t.b.f. to the required level. The test programme is described and resulting failures are analysed. Corrective measures taken are outlined and the results after modifications are analysed. W.G.Stripp

621.396.933.23

486 AN IMPROVED INSTRUMENT LOW APPROACH SYSTEM COMPATIBLE WITH TACAN.

M.Karpeles and E.G.Parker.

I.R.E. Nat. Convention Record, Vol. 7, Pt 5, 43-53 (1959).

The complete TACAN I.L.S. system, as well as the theory of a variable phase slope aerial,are described. The principal advantages of this system are described as accurate definition of the space coordinates of the approach funnel allowing the selection, in the aircraft, of an optimal approach path; better utilization of aerial aperture; the TACAN ground equipment is lighter and more mobile; airborne equipment requires a minimum of added weight and volume while permitting the elimination of three separate receivers. A.Reiss

621.396.933.23

487 NEW GLIDE-SLOPE CONCEPTS FOR INSTRUMENT LANDING GUIDANCE. A.Tatz and F.H.Battle, Jr.

I.R.E. WESCON Convention Record, Vol. 3, Pt 5, 84-8 (1959).

Modifications and improvements to the standard I.L.S. glide-slope proposed over recent years are summarized and discussed. Most of these proposals have not yet been put into effect. The main topic of the paper is to analyse the guidance relationships and to explore probable data sources which can be used to implement these relationships and so provide some of the desired improvements to I.L.S. systems. Curves are given of the various new techniques which are proposed, and for each system considered the instrumentation and the accuracy of the resulting trajectory is discussed. K.C.Garner

621.396.946 : 621.398

488 SPACE VEHICLE ELECTROMAGNETIC COMMUNICATIONS AND TRACKING. H.Hoffmann, Jr.

I.R.E. Nat. Convention Record, Vol. 7, Pt 5, 227-39 (1959).

The problems of tracking are considered for a space vehicle on a journey to Mars. Two tracking systems are considered. In the first, pulses from the vehicle are received at four stations, one terrestrial and three based on earth satellites. The second system requires six earth satellites as stations for recording Doppler shift. Power requirements and accuracy are discussed. For full range the pulse system would require an impracticable power but the Doppler system could operate with a transmitted power of 100 W, and at the same time provide a 100 c/s communication channel. W.T.Blackband

621.396.946

489 ELECTROMAGNETIC EFFECTS ASSOCIATED WITH HYPERSONIC RE-ENTRY VEHICLES. R.F.Whitmer.

I.R.E. WESCON Convention Record, Vol. 3, Pt 1, 3-8 (1959).

The effects considered are the absorption and reflection of signals transmitted to or from a re-entry vehicle surrounded by an ionized shock layer, and the effects of this layer on the performance of an aerial on the vehicle. On the assumption that transmission from the vehicle is through a plane layer of uniformly ionized gas, and that reception in the vehicle is through a similar layer backed by a metal plate, sets of curves are computed giving reflection and attenuation against electron density for various values of ν/ω (the ratio of electron-neutral particle collision frequency, to transmitted radiofrequency). Curves show the effect of vehicle speed on the breakdown power for a given aerial. W.T.Blackband

621.396.946 : 538.56

490 REFRACTION OF VERY HIGH FREQUENCY RADIO SIGNALS AT IONOSPHERIC HEIGHTS.

S.Weisbrod and L.Colin.

Nature (London), Vol. 184, 119 (July 11, 1959).

A consideration of the refractive errors encountered in the radio tracking of space vehicles due to the influence of the earth's atmosphere. Tropospheric refraction is only appreciable at low elevation angles, but ionospheric refraction introduces an error which increases with elevation to a maximum value depending on the height of the ionospheric layer. Graphs are given of the variation of these errors with elevation angle. G.M.Brown

621.396.946 : 525

491 RADIO OBSERVATIONS WITH SATELLITE 1958δ OVER AUSTRALIA.

A.J.Herz, K.W.Ogilvie, J.Olley and R.B.White.

Nature (London), Vol. 184, 391-5 (Aug. 8, 1959).

This is a preliminary analysis based on an incomplete knowledge of the telemetry system. It is suggested that there is a minimum in the intensity of radiation at a latitude of 35°S, and that this could correspond to the gap between the inner and outer radiation belts. There is some evidence of a time variation in the radiation intensity. H.J.A.Chivers

621.396.946

492 METHODS OF OBSERVING THE SOLAR RADIOWAVE RADIATION. J.Budéjický.

Slaboproudy Obzor, Vol. 20, No. 7, 435-44 (1959). In Czech.

This survey is a continuation of an earlier article (see Abstr. 5579 of 1959). It is pointed out that measurements of solar radiation are generally made at wavelengths extending from 3 cm to 3 m. The main measured quantity is the intensity of radiation (at a given wavelength), but the distribution, polarization and spectral content are also of interest. The equipment used in measurements comprises: (1) single-beam radiotelescopes; (2) radio-interferometers; (3) Ryle-type interferometers; (4) interferometers with a vibrating beam; (5) Christiansen-type arrays (radioheliographs); (6) radio spectrographs; and (7) polarimeters. The theory and operation of these devices is briefly described. R.S.Sidorowics

621.396.96

493 PACKAGED HIGH POWER RADAR TRANSCEIVERS. H.N.C.Ellis-Robinson.

I.R.E. Nat. Convention Record, Vol. 6, Pt 8, 74-86 (1958).

A brief outline of the specification requirements is given and certain aspects are discussed in detail to illustrate their effect on the design. A special feature is the incorporation of all primary and secondary test instrumentation as part of the basic design. An illustrated description of two of the resulting designs, one in S-band, 2700-2900 Mc/s, 5 MW peak power, and one in L-band, 1300-1365 Mc/s, 2.5 MW peak power, is given as examples of practical application. J.W.Lee

621.396.96 : 681.142

COMPUTER FOR SEQUENTIAL ACCESS TO RADAR TRACKING INFORMATION. See Abstr. 555

621.396.962.33

494 GROUND CLUTTER ISODOPS FOR COHERENT BISTATIC RADAR. H.A.Crowder.

I.R.E. Nat. Convention Record, Vol. 7, Pt 5, 88-94 (1959).

Isodops are lines of constant Doppler shift on the earth's surface relative to a moving receiver and/or transmitter. Such contours define a region which represents the effective radar cross-section of the earth for coherent doppler radar. While the active case, in which the transmitter and receiver have a common location and velocity, is well known, the bistatic or semi-active case in which the two velocities and/or locations differ is more involved. A general equation is formulated for the semi-active isodops, from which the active clutter isodops are shown to fall out as a special case. Use of the isodops to determine signal-to-clutter ratios in the radar receiver is demonstrated. A numerical method of computing both the isodops and signal-to-clutter ratio is described. Some illustrative semi-active isodops are presented.

621.396.963.84

495 COLLISION DETECTION WITHOUT RANGE DATA. Y.J.Liu and J.O.Campbell.

Electronics, Vol. 32, No. 30, 60-3 (July 24, 1959).

The "Anti-Collidor", herein described, is based on the principle that the relative velocity vector between two aircraft must coincide with the line of sight (L.O.S.) between them for a collision to occur. Relative velocity of two aircraft, equipped with this system, near enough to the same altitude to collide is computed, by analogue techniques, and the l.o.s. is determined. The device gives a warning signal whenever the relative velocity vector is within a few degrees of the l.o.s. Basic operating principles and a block diagram are given. A.Reiss

621.396.965.8

496 AN AUTO-FOLLOW SYSTEM WITH DISCONTINUOUS INPUTS. J.Clergue.

Onde elect., Vol. 39, 345-51 (May, 1959). In French.

An auto-follow system is described in which the radar information about the aircraft position is used intermittently. The aircraft position and velocity are measured and used to forecast the position in which the aircraft will be when the next step of information will be required. A gate is used to pick out the signal wanted and automatic acquisition may be arranged. Provision is made for manual follow when the signal is temporarily lacking (due for instance to hills). Four aircraft or groups of aircraft may be tracked simultaneously with this apparatus. T.Horrocks

621.396.968.825

497 AN APPLICATION OF THE THEORY OF GAMES TO RADAR RECEPTION PROBLEMS. N.J.Nilsson.

I.R.E. Nat. Convention Record, Vol. 7, Pt 4, 130-40 (1959).

The problem of radar reception in the presence of jamming is treated by an application of the theory of games. The game formulation used is as follows: assume the radar receiver employs a matched filter, matched to the radar echo signal. Let the choices of band-limited power spectral distributions for both the radar signal and the jamming noise constitute the respective strategy decisions for the radar designer and the jammer. Games with strategies of this type are known as function-space games. For each opponent optimum spectral strategies are specified when the payoff function is the receiver output signal-to-noise ratio or the mean squared time error in target location. A new expression for this output signal-to-noise ratio is used which reduces to the familiar $2E/N_0$ for the case of constant density noise jamming. When the output s.n. ratio is the game payoff function, the optimum spectra are shown to be constant density, band-limited spectra for both the radar signal and the jamming noise. It is also shown that the game theoretically optimum linear receiver is a matched filter receiver. When the time error is used as a payoff function, the set of spectra from which the radar designer may choose is limited in a certain way so that the resulting game may be more easily solved. Even after this limitation, a special trick must be used, to solve the game. Optimum spectra for this game turn out to be other than simple constant density spectra.

621.396.969

498 A NEW AIRBORNE PROFILE RECORDER. W.V.O'Leary.

Hawker Siddeley tech. J., Vol. 1, No. 2, 52-7 (Spring-Summer, 1959).

The equipment determines the relative heights of points on the ground along the surveying aircraft's flight path, and can thus measure terrain clearances from 1000 to 35 000 ft. A height deviation indicator (hypsometer) automatically compensates for variations from the chosen barometric flying height, and so gives an exceptionally accurate terrain profile record.

621.396.969.35

499 MOBILE RADAR PINPOINTS ENEMY MORTAR POSITIONS. M.S.Yaffee, W.F.Smith and J.B.Skully.

Electronics, Vol. 32, No. 38, 34-7 (Sept. 18, 1959).

A general account of a set for locating enemy mortars at ranges up to 10 km with an accuracy of ±50 m. A scanner emits 2 radar beams with a vertical separation of 2° and operating over a range of 25° in azimuth. The scanning rate is 1000 rev/min which enables the shell to be located in flight; the time difference between its passage between the 2 beams is measured, fed manually into a computer which assumes a parabolic trajectory and calculates the position of the source of the shell. The final result is given in terms of map coordinates. The usual precautions are taken against radar clutter. A block diagram is given, but no circuit details or test results. N.Corcoran

621.396.969.35

500 LOW-COST ACTIVE RADAR FOR MISS-DISTANCE DATA. W.H.Doty.

Electronics, Vol. 32, No. 47, 91-3 (Nov. 20, 1959).

A new miss-distance indicator (m.d.i.) system is described which requires no equipment in the test missile, needs negligible data processing on the ground and avoids the use of a telemetry link: designed for installation in the test target (drone), the cost is ≃ $2000. The frequency difference between an f.m. transmitter and the missile-reflected signal is measured in a discriminator which controls the sweep rate so as to maintain this difference at a constant value. A receiver and c.r.o. or tape recorder on the ground are used to record the sweep rate which, at its maximum, gives a direct measure of miss-distance. To avoid Doppler effects, a triangular sweep waveform is used. A.Reiss

621.396.969.35

501 SPUTNIK II AS OBSERVED BY C-BAND RADAR. D.K.Barton.

I.R.E. Nat. Convention Record, Vol. 7, Pt 5, 67-73 (1959).

Two transits of satellite 1957 β were observed from Grand Bahama Island using an AN/FPS 16 radar. Details of the radar and its performance are quoted. From the fading patterns of the radar returns a possible configuration for the satellite was deduced and a length of 50 ft estimated. It was concluded that corner reflectors were carried, and that the target had a pitching motion with a tumbling period of about 195 sec. W.T.Blackband

621.396.969.35

502 TRACKING PIONEER IV BEYOND THE MOON. R.E.Anderson and A.D.French.

I.R.E. Nat. Convention Record, Vol. 7, Pt 5, 152-7 (1959).

A receiving station set up in order to track Pioneer IV is described. The receiver is of special high stability, using a phase-locked local oscillator to derive a 1st i.f. of 30 Mc/s, which is later converted to 455 kc/s, at which frequency the signal is compared with inphase and phase-quadrature outputs of a stable oscillator in order to provide demodulation and received signal amplitude. An estimate of the range performance of the system agrees well with that observed. The angular position of the transmitter could be determined to ± 1° by a directive aerial on a naval gun mounting. W.T.Blackband

621.396.969.35

503 MISSILE MISS-DISTANCE INDICATOR. A.E.Hayes, Jr.

I.R.E. Nat. Convention Record, Vol. 7, Pt 5, 204-7 (1959).

The system described utilizes the radiation resistance of an aerial which is fixed to the target. This resistance, in the vicinity of a moving object, contains an a.c. component having an audio frequency which is a function of the velocity of the moving object with respect to the aerial. Since at the moment the missile is passing the target there is no relative motion between the two, this component has zero frequency. This frequency variation depends in no way on the shape or size of the moving object but only on its relative velocity and path. This signal is applied to a transmitter in the target aircraft which passes the information to a ground computing station where the miss-distance is calculated. A block diagram is given also a graph giving a plot of the frequency of the a.c. component as it varies with the missile position and elapsed time. The equipment on the target weighs less than 5 lb. The system has been successfully tested. B.B.Austin

621.396.97

504 THE A.B.C. SYDNEY PROGRAMME CENTRE. F.M.Shepherd.

Proc. Instn Radio Engrs Australia, Vol. 20, No. 8, 457-62 (Aug., 1959).

Describes a recently completed programme centre which controls a large multistudio group and feeds the transmitter networks. Various choices of arrangement and control are outlined, and it is shown that the method adopted was the most logical one. The system provides a flexible and expandable arrangement of motor uniselectors and relays which provides interconnections between studios, stations and recording facilities.

TELEVISION

621.397.132

505 STANDARDIZATION PROBLEMS IN EUROPEAN COLOUR TELEVISION. W.Gerber.

Tech. Mitt. P.T.T., Vol. 37, No. 7, 262-7 (1959). In German.

After a brief review of the principles of the N.T.S.C. system and the present state of the art, a strong plea for European standardization is made. Diagrams of channel characteristics are shown and support the need of and reasons for standardization. The main problems in the planning of an European transmission system, particularly in the u.h.f. bands IV and V, viz. the vision–sound carrier spacing and the Nyquist flank shape, are discussed, and the adoption of a standard chrominance sub-carrier of 4.43 Mc/s for both C.C.I.R. and O.I.R. systems is recommended.

A.Landman

621.397.132

506 N.T.S.C. COLOUR-TELEVISION SIGNALS. MEASUREMENT TECHNIQUES. J.Davidse.

Electronic Radio Engr, Vol. 36, No. 10, 370-6 (Oct., 1959).

Deals with some statistical properties of N.T.S.C. colour-television signals obtained from normal picture material. Numerical data is given on the average signal excursion of the I and Q signals and on the distribution of the momentary levels of the sub-carrier amplitude and of the luminance signal. Some measurements on monochrome signals are included. The measurements are discussed briefly and a short description is given of the measuring circuits. The given values are restricted to "first-order statistics"; no measurements have been carried out on correlation problems and the like.

621.397.23 : 621.398

507 SYSTEM DESIGN CRITERIA FOR SPACE TELEVISION. A.J.Viterbi.

J. Brit. Instn Radio Engrs, Vol. 19, No. 9, 561-70 (Sept., 1959).

A narrow band television system for relaying to earth images of the planets is described. The principal consideration is the necessity of communicating over extremely long ranges. Because of the resulting high noise environment, the channel bandwidth is severely restricted. Bandwidth compression is achieved by storing the video signal on magnetic tape or photographic film and transmitting at a reduced information rate. An f.m.-p.m. telemetry system is utilized. The doppler-shifted carrier is recovered from the noise by a very narrow tracking filter or phase-locked loop. The derived carrier is mixed with the incoming signal to yield the noisy video information. The discriminator is also a phase-locked loop with sufficient bandwidth to track the information signal. The recording operation is reversed at the receiver to present the video image at periodic intervals, or a facsimile technique may be employed. The main interest of the paper is directed toward the theory and design of the very narrow band telemetry system and the unconventional discriminator required for ultra-long-range television communication.

621.397.23

508 NOTE ON THE REDUCTION OF THE QUANTITY OF INFORMATION CONTAINED IN A TELEVISION PICTURE. A.V.J.Martin.

Onde elect., Vol. 39, 686-9 (July-Aug., 1959). In French.

The maximum information contained in a television picture is determined by the signal-to-noise ratio and a curve is given showing the relationship. The information contained in the picture can be halved by quantizing the levels of luminosity using only eight gradations of intensity between black and white. If account is taken of the redundancy arising from correlation of intensity between neighbouring points the information contained can be halved yet again without apparent reduction in picture quality. G.D.Sims

621.397.3 : 621.395.625.3

509 F.M. CARRIER TECHNIQUES IN THE R.C.A. COLOR VIDEO TAPE RECORDER. R.D.Thompson.

I.R.E. Nat. Convention Record, Vol. 7, Pt. 7, 109-16 (1959).

The carrier frequency is about 5 Mc/s and by providing equalization in the playback circuits and introducing a low-pass filter with cut-off just above the carrier, the characteristics of tape and f.m. system are made complementary. Distortion arising from attenuation of the upper sidebands is negligible. The modulated oscillator has a frequency of about 50 Mc/s and it is heterodyned by a fixed 45 Mc/s oscillator to provide an f.m. carrier of the correct frequency at the recording head. On the playback side, a push-pull amplifier and clipper drive a balanced discriminator of the quadrature type. Prior to equalization the video response shows a 3.5 dB drop at 4.0 Mc/s. H.G.M.Spratt

621.397.331.24

510 CONTROL OF SCREEN QUALITY OF CATHODE RAY PICTURE TUBES. J.T.Bannigan.

Proc. Instn Radio Engrs Australia, Vol. 20, No. 9, 513-18 (Sept., 1959).

Screen quality is defined as the absence of disturbing defects. Its maintenance in mass production depends upon the careful control and testing of materials and processing. Proper selection and training of inspectors is the most important factor in quality control.

621.397.334 : 621.374.33

511 A GATING CIRCUIT FOR SINGLE-GUN COLOUR TELEVISION TUBES. K.G.Freeman.

J. Brit. Instn Radio Engrs, Vol. 19, No. 11, 667-77 (Nov., 1959).

The requirements of an ideal gating circuit with single-gun colour television tubes and the limitations of some existing circuits are discussed. A new type of gating circuit which employs low-level gating of the red, green and blue video signals in conjunction with a wideband amplifier is described. Such a circuit is believed to have a performance superior to that of most existing circuits and by fairly simple modification is applicable to either reversing colour sequence, continuous colour sequence or to colour difference operation.

621.397.335.12

512 PRACTICAL PROBLEMS RELATING TO THE INSERTION OF STANDARD SIGNALS IN THE VERTICAL BLANKING PERIOD IN TELEVISION. J.Tasso.

Onde elect., Vol. 39, 374-84 (May, 1959). In French.

The principal problem discussed is that of distinguishing between the synchronizing pulses for odd and even frames. In the 625-line system the odd frame pulse does not coincide with a line pulse, while the even frame pulse does. Addition of line and frame pulses and subsequent clipping enable the even frame pulse to be picked out. Somewhat more complex methods are needed to select the odd frame pulse; some of these are described. The selected pulse is differentiated and triggers a series of counters to produce a trigger pulse 33 lines after the frame pulse. The trigger pulse initiates the production of the standard signals to be inserted. A complete circuit of the equipment up to the production of the trigger

pulses is given. Generators of single and double pulses, linear saw-tooth and staircase waveforms and trains of sinusoidal waves are also described. W.G.Stripp

621.397.6

513 MEDICAL COLOUR TELEVISION EQUIPMENT. M.Favreau and J.Soffer.
Onde elect., Vol. 39, 665-72 (July-Aug., 1959). In French.

The equipment uses sequential frame scanning, with a single image orthicon in the camera, and motor-driven colour filters. The signals representing the three colours are equalized in gated amplifiers. The receiver uses a monochrome c.r.t. with colour filters synchronized to those at the camera. Some circuit details are given. W.G.Stripp

621.397.6

514 PROFESSIONAL EQUIPMENT FOR COLOUR TELEVISION USING SIMULTANEOUS TRICHROMATIC ANALYSIS. A.Nepomiastchy.
Onde elect., Vol. 39, 680-5 (July-Aug., 1959). In French.

The equipment described is for the N.T.S.C. system and includes cameras, a control bay, a flying spot scanner for colour positives and a colour monitor. W.G.Stripp

621.397.61

515 PROGRESS IN THE FIELD OF TELEVISION REPORTING. A NEW ULTRA-LIGHT CAMERA SYSTEM. R.Cahen and R.Fontenit.
Onde elect., Vol. 39, 673-9 (July-Aug., 1959). In French.

The new camera (CP 102) can be held in the hand and contains a sensitive vidicon tube. The lens has a focal length variable from 20 to 80 mm. A case carried on the back contains transistorized synchronization circuits, video amplifiers and a transmitter. This may be for Band III, Band IV or for 7000 Mc/s. No circuits are given. W.G.Stripp

621.397.61

516 TRANSISTORIZED VIDEO SWITCHING. C.R.Monro, J.W.Wentworth and A.C.Luther, Jr.
I.R.E. Nat. Convention Record, Vol. 7, Pt 7, 130-9 (1959).

Outlines the principles of a method by which a television studio controller may switch from one camera to another by a process lasting about 1 μs, timed to occur at the interval between successive pictures. The switch used is a diode, turned on or off by two transistors which form a bistable flip-flop. Up to 11 cameras can be in use at any one time and a "tally" circuit indicates which of these 11 has been selected by the controller to be "on the air". Simplicity and reliability are claimed. Block diagrams and photographs are included, but no circuit component values. N.Corcoran

621.397.61

517 TELEVISION RETRANSMITTERS [TRANSLATORS] OF THE COMPAGNIE FRANCAISE THOMSON-HOUSTON, 300 MILLIWATTS (TH-T 669) AND 3 WATTS (TH-T 670). M.Nadeau.
Onde elect., Vol. 39, 368-73 (May, 1959). In French.

Design principles are based on complete coverage of metropolitan areas without any loss of quality. Requirements and problems are discussed, and a table of local-oscillator frequencies, against received and retransmitted channels, is given. The 300 mW equipment is common to sound and vision signals and uses single frequency-changing and a common aerial. In the 3 W equipment, however, sound and vision signals are separated, after frequency-changing, and are transmitted from two separate aerials or from a single aerial with a diplexer. Operation, block schematics and performance are given. 3 references. A.Reiss

621.397.61

518 HIGH-POWER TELEVISION TRANSMITTERS FOR BANDS IV AND V. T.S.Robson and T.M.J.Jaskolski.
Proc. Instn Elect. Engrs, Paper 3070 E, publ. Nov., 1959 (Vol. 106 B, 528-40).

To increase the number of channels available for television broadcasting, it is now becoming increasingly necessary in several countries to utilize the ultra-high-frequency bands (Band IV, 470-585 Mc/s, and Band V, 610-960 Mc/s). The paper considers some of the factors concerning the relatively restricted coverage on ultra-high frequencies and the power requirements of transmitters to offset this disadvantage. This leads to a discussion on the choice of valve types for use in u.h.f. television transmitters. The choice of a high-gain klystron output amplifier for a 10kW transmitter enables a relatively low-power modulated amplifier to be used in the penultimate stage. Describes the fully engineered transmitter installed experimentally at the B.B.C. television transmitting station at Crystal Palace for propagation and television reception in the u.h.f. band covering both the 405-line and 625-line television systems.

621.397.61

519 UNDERWATER TELEVISION. J.Beaugrand, A.Gruget and M.Sivirine.
Onde elect., Vol. 39, 742-53 (Sept., 1959). In French.

Modifications to an industrial television equipment are described for the solution of mechanical, optical and electrical problems arising from underwater conditions. The second part deals with the general applications of such systems in commercial, scientific and military fields. A.Reiss

621.397.611

520 A PRECISION COLOUR TELEVISION SIGNAL SOURCE FOR RESEARCH PURPOSES. J.E.Benson.
Proc. Instn Radio Engrs Australia, Vol. 20, No. 8, 472-86 (Aug., 1959).

After an introductory statement on the present status of colour television in America and England, some of the problems of producing a precise colour television signal for research purposes are discussed in relation to a new colour slide scanner and monitor. This equipment, which is capable of producing colour video signals with sufficient precision and stability to serve as a reference standard for research and test purposes, is described in the concluding section.

621.397.612

521 A VECTORSCOPE UNIT. K.G.Freeman.
Electronic Engng, Vol. 31, 655-8 (Nov., 1959).

A high-sensitivity vectorscope unit is described which provides a vectorial display of N.T.S.C.-type chrominance signals. It incorporates a number of features, including means for continuously checking gain and quadrature adjustments. The instrument permits rapid assessment of chrominance signal phase and amplitude characteristics — which are of particular importance in direct-decoding operation of single-gun colour television tubes.

621.397.62

522 SOME ASPECTS OF TELEVISION RECEPTION ON BAND V. H.N.Gant.
J. Brit. Instn Radio Engrs. Vol. 19, No. 11, 727-33 (Nov., 1959).

The problems facing the designer of a television receiver for use on Band V are considered. Choice of aerial, signal/noise ratio and oscillator stability are discussed in some detail in respect of performance and complexity, and suitable valves for signal frequency amplifiers and oscillators are reviewed. Various possible arrangements for the front end of such a receiver are assessed. Some experimental results achieved with an experimental tuner using normal mass production techniques and components are discussed and the construction of this unit described.

621.397.621

523 DESIGN OF TRANSISTOR VERTICAL DEFLECTION OUTPUT AND DRIVER STAGES. M.J.Hellstrom.
I.R.E. Trans Broadcast and Televis. Receivers, Vol. BTR-5, No. 2, 7-17 (May, 1959).

Optimum ratios for the inductances and resistances of the choke and the yoke, and values of other parameters, are determined for an a.c. coupled driver and output stage, using common-emitter configurations and a typical yoke. W.G.Stripp

621.397.7

524 C.B.C. STUDIOS 7 AND 42 VIDEO AND AUDIO FACILITIES. N.R.Grover.
Engng J., Vol. 42, No. 9, 92-7 (Sept., 1959).

These television studios, one in Toronto and the other in Montreal, are similar in layout and construction. The studio plan and the camera, audio, lighting, intercom. and testgear facilities are described in detail, with particular emphasis on video-switching arrangements and synchronizing. A new artificial reverberation unit employed consists of a large steel plate with input and output transducers welded to it. Studio 7 is located in a separate building from that housing the main television plant and owing to the considerable difference in earth potentials of these buildings, severe noise was experienced at first. This effect was cured by including in each coaxial line from one building to the other an extra 100 ft of cable which was wound toroidally on a magnetic core. H.G.M.Spratt

621.397.7

525 GAP FILLING TRANSLATORS AND TRANSMITTERS. W.J.Morcom.

J.Brit. Instn Radio Engrs, Vol. 19, No. 10, 649-60 (Oct., 1959).

Due to topographical conditions areas often exist inside the service area of a television station where the field strength is inadequate for normal domestic receivers to operate. Apparatus is described which, mounted on high ground, can receive the programme and convert it to another frequency and re-radiate it into these areas. Regions beyond the service area of the television transmitter can be served by using a combination of a link system and a booster transmitter. For those areas where locally generated programmes are required for certain periods, apparatus for feeding in video and audio signals is described.

621.397.7

526 SOME ASPECTS OF THE DESIGN OF A SMALL TELEVISION STATION. A.Harris.

J. Brit. Instn Radio Engrs, Vol. 19, No. 11, 705-21 (Nov., 1959).

Some of the factors governing the choice of equipment for use in small commercial television stations in isolated areas are discussed. Specific reference is made to two different types of installation at station ZBM-TV, Bermuda, using the same basic equipment. The two systems described relate to (a) a combined television centre containing both studio and transmitter in the same building; and (b) separate studio and transmitter sites. The equipment used included vidicon telecine and studio cameras and a 500 W vision transmitter; details are given of these items and also of vision, sound and control facilities.

621.397.74

527 COMMUNICATIONS IN INDEPENDENT TELEVISION. L.F.Mathews.

J. Brit. Instn Radio Engrs, Vol. 19, No. 9, 545-52 (Sept., 1959).

The effect of expanding demand on the design of a network for the conveyance of vision, sound and the control of programmes within a television programme organization is described. Reference is made to problems associated with exchange of programmes with similar organizations. Outside broadcast radio links and methods adopted whereby a number of contractors can participate in a composite link are discussed. A new microwave link for monitoring purposes is described, with particular reference to the automatic switching and monitoring facilities carried out over an associated u.h.f. link. Uses of the communication systems other than for scheduled programme transmission are described, and a short account of future plans and developments is given.

621.397.743

528 C.B.C. TELEVISION NETWORK PROGRAM DELAY CENTRE. G.E.Waters.

Engng J., Vol. 42, No. 7, 63-7, 84-5 (July, 1959).

This delay centre is necessitated by the different time zones covered by the Canadian coast-to-coast network. All the western zone programmes are referred back to Toronto (Eastern standard time) as the originating centre and accordingly the delay centre is located in Calgary (Mountain time and two hours behind Eastern standard time). Programmes originating in Toronto are received over a radio link and recorded at Calgary by means of an installation of seven Ampex video tape machines. Details are given regarding monitoring, master-control equipment, listening booths and system performance. H.G.M.Spratt

621.397.81

529 REPORT OF T.A.S.O. COMMITTEE 3.3 ON CORRELATION OF PICTURE QUALITY AND FIELD STRENGTH. C.M.Braum and W.L.Hughes.

I.R.E. Nat. Convention Record, Vol. 7, Pt 7, 150-8 (1959).

Reports the results of reception surveys made in 11 areas in the United States. Tables are given for the minimum field-strength found to be required in general for passable and good picture reception at varying frequencies from low v.h.f. to high u.h.f. Whereas u.h.f. field strength and picture quality deteriorated rapidly for distances beyond the optical line of sight v.h.f. was satisfactory for much greater distances. In areas of adequate signal strength u.h.f. did not appear to be subject to ignition noise, aeroplane flutter, etc. G.D.Sims

621.397.81

530 THE FIELD STRENGTHS REQUIRED FOR THE RECEPTION OF TELEVISION IN BANDS, I, III, IV AND V. G.F.Swann.

Proc. Instn. Elect. Engrs, Paper 2816 R, publ. Jan., 1959 (Vol. 106B, 541-7).

Republication, with discussion, of the paper abstracted in Abstr. 1226 (1959).

621.397.828 : 621.315.2

531 A NEW METHOD OF SUPPRESSING LOW-FREQUENCY NOISE SIGNALS ON TELEVISION CABLES. R.Rasch.

Nachrichtentech. Z. (N.T.Z.), Vol. 12, No. 8, 416-18 (Aug., 1959). In German.

Refers particularly to mains-hum picked up on coaxial video cables. The method is to arrange to feed the cable from a high-impedance anode circuit rather than the usual cathode-fed system. This reduces the proportion of the induced mains frequency e.m.f. which appears across the load impedance at the receiving end of the cable. V.G.Welsby

621.397.9

532 THE USE OF TELEVISION FOR THE MICROSCOPICAL EXAMINATION OF RADIOACTIVE METALS. E.C.Sykes.

J. Brit. Instn Radio Engrs, Vol. 19, No. 9, 555-60 (Sept., 1959).

Closed circuit television for relaying the image produced by remotely controlled microscopes enclosed within thick lead shields, and used for the examination of highly radioactive irradiated fissile materials, e.g. uranium 235, is described. Brief details are given of two installations incorporating respectively c.p.s. emitron, and image orthicon camera chains. A device is described which accurately measures the microstructural features displayed on the monitor screens. The advantages and disadvantages of television compared with optical viewing are discussed, and brief mention is made of experiments with television for general remote handling.

621.397.9

533 AN X-RAY IMAGE AMPLIFIER USING AN IMAGE ORTHICON CAMERA TUBE. A.Garthwaite and D.G.Haley.

J.Brit. Instn Radio Engrs, Vol. 19, No. 10, 615-23 (Oct., 1959).

Special requirements of a television camera for use as an X-ray image amplifier are outlined. In television, illumination can be controlled, whereas in this X-ray application illumination is controlled by the thickness of the subject under examination. Details are given of the special camera tube which has been developed to operate under these conditions and also of the ancillary apparatus required to obtain maximum sensitivity and definition from such a tube. The reason for adopting a scanning system not compatible with any of the accepted standards is also discussed.

621.397.9

534 A DESIGN FOR USING CLOSED-CIRCUIT TELEVISION IN EDUCATION. F.E.Almstead.

Trans. Amer. Inst. Elect. Engrs I, Vol. 78, 439-44 (1959) = Commun. and Electronics, No. 44 (Sept., 1959).

CONTROL . DATA PROCESSING

CONTROL AND SERVO SYSTEMS

621-5

535 NUMERICAL CALCULATION OF TRANSIENT REGIMES IN LINEAR AND NONLINEAR SYSTEMS. NUMERICAL SIMULATION METHOD. P.Naslin.
Automatisme, Vol. 4, No. 7-8, 293-300 (July-Aug.); No. 9, 340-3 (Sept., 1959). In French.

The first step in the method described consists of redrawing the functional block diagram in a form in which each individual block represents either a straight gain or a simple integrator. The calculation of the output then proceeds by a step by step method using what amounts to a form of difference calculus. For linear cases the application is trivial but for nonlinear and time-dependent cases it leads to useful results. It is pointed out that the accuracy of the results may be improved by making the method iterative. A large number of examples demonstrate the application of the method.
T.Horrocks

621-52

536 AN OPTIMUM CONTROL WITH CONSTRAINTS. R.Kulikowski.
Bull. Acad. Polon. Sci. Ser. Sci. tech., Vol. 7, No. 4, 285-94 (1959).

A study of control systems with constraints carried out by statistical methods and based on work of Newton, Westcott and others. Discussion of basically linear (but saturated) systems is followed by consideration of fully non-linear control. Finally an optimization on the basis of minimum (r.m.s.) distortion in the presence of constraints is evolved.
T.Horrocks

621-52 : 621.9

537 AUTOMATIC CONTROL SYSTEMS FOR MACHINE TOOLS.
Engineer, Vol. 208, 137-9 (Aug. 28, 1959).

Brief descriptions of machine tool control systems recently introduced, and employing diffraction-grating measuring techniques; they comprise two transistor–hydraulic magnetic-tape controlled continuous-control milling machines, a numerical position control coordinate table, and a coordinate inspection machine.
A.O.Stanesby

621-52

538 A MAGNETIC AMPLIFIER FLOW CONTROLLER. H.E.Darling.
Trans. Amer. Inst. Elect. Engrs I, Vol. 78, 373-9 (1959) = Commun. and Electronics, No. 44 (Sept., 1959).

An all-magnetic amplifier controller is described. The design has the long life and dependability and meets the exacting accuracy and stability requirements of industrial process control. It is intended primarily for fast response (flow) processes, and is designed for 10-50 mA d.c. input and output.

621-526

539 ON ADAPTIVE CONTROL PROCESSES. R.Bellman and R.Kalaba.
I.R.E. Nat. Convention Record, Vol. 7, Pt 4, 3-11 (1959).

Discusses the application of the functional equation technique of dynamic programming to the formulation and solution of optimization problems in the design of adaptive devices. The technique is illustrated by application to an inhomogeneous Van der Pol equation, in which the forcing term is a stochastic function, whose properties are partially known, to a feedback control device which seeks to keep the system in the unstable equilibrium state at the origin. By observing the properties of the forcing term, the controller may, with the passage of time, infer more about its statistical nature and thus improve the quality of its control decisions, viz. the controller "adapts" itself to the processes it seeks to control.
G.D.Sims

621-526

540 EXTENSION OF PHASE PLANE ANALYSIS TO QUANTIZED SYSTEMS. P.H.Ellis.
I.R.E. Nat. Convention Record, Vol. 7, Pt 4, 45-56 (1959).

The method of analysis described refers to control systems in which the input and output data are discretely valued, without necessarily involving periodic sampling, and with particular reference to machine-tool control and similar processes. Various systems are considered by the phase plane method, which limits the applicability to systems whose output depends on no higher than the second derivative of itself. Various non-linearities may be treated by this method and the similarity to the analysis of systems with backlash is pointed out.
T.Horrocks

TELECONTROL . TELEMETERING

621.398 : 621.33

541 SOME CONSIDERATIONS OF THE PROBLEMS OF TELECOMMAND AND THEIR SOLUTION. R.Arnold and L.Le Goff.
Bull. Soc. Franc. Elect., Vol. 9, 389-98 (July, 1959). In French.

Discusses at the start the more important factors which determine the method of transmission. In railways systems, the use of the rails for signalling is studied and the many disadvantages, from the point of view of reliability, e.g. noise level and resistance variation, are emphasized. The transmission system on the S.N.C.F. is described. It consists of a central and a satellite post, which can be several km apart. The transmission link is provided by six lines along which positive and negative pulses are sent. At the receiving end the pulses are used to operate relays which in turn control the signalling system. The relays operate several hundred million times per annum and facilities for easy replacement are provided.
H.G.M.Spratt

621.398 : 621.311.4

542 THE REMOTE CONTROL OF SWITCHING IN TRANSMISSION AND DISTRIBUTION STATIONS. R.Pinet and R.Galy.
Bull. Soc. Franc. Elect., Vol. 9, 461-8 (Aug., 1959). In French.

After indicating the general directives laid down by Electricité de France, the functioning is explained and various methods of installation and operation are described for the case of high and very high voltage. Examples of actual installations are given and it is concluded that the system will have an extended use in future.
R.G.Jakeman

621.398 : 621.311.47

543 THE USE OF REMOTE CONTROL FOR THE OPERATION OF MEDIUM-VOLTAGE DISTRIBUTION STATIONS. M.Régent.
Bull. Soc. Franc. Elect., Vol. 9, 469-70 (Aug., 1959). In French.

A brief comparison between the use of automation and remote control for switching.
R.G.Jakeman

621.398

544 MODERN SYSTEMS OF TRAFFIC CONTROL AS APPLIED TO THE SEABOARD AIR LINE RAILROAD COMPANY. J.R.DePriest.
Trans Amer. Inst. Elect. Engrs II, Vol. 78, 168-72 (1959) = Applic. and Industr., No. 43 (July, 1959).

Prior to December, 1941, the Seaboard Line consisted of a single-track railway with more than 4000 miles of main and branch track between Richmond, Virginia, and Miami, Florida, with hand signalling and physical delivery of train-running orders. At that time, the first section of 33 miles of automatic remote control from a point, 157 miles distant, was installed. The basic requirements are reviewed for controlling trains safely on a single-line (with sidings) system, it is shown that 6 bits of information are needed for control purposes, and 8 bits are needed for indicating purposes at each siding switch in traffic control territory. The system described in the succeeding abstract for indicating 7 bits of information for up to 35 stations can be used for this purpose (with a logical reduction of the 8-bit requirement to one of 7 bits); and signalling (including telephony) for the now completed system is carried out on a Western Electric Co. carrier system which provides 3 trunk channels on a single pair. The territory is divided into 3

major zones, and three traffic control machines for each zone are located at zone centres. Some details of the actual wayside stations are described. W.J.Mitchell

621.398

545 TRAFFIC CONTROL FOR RAILROADS. G.W.Baughman.
Trans Amer. Inst. Elect. Engrs II, Vol. 78, 173-6 (1959) = Applic. and Industr., No. 43 (July, 1959).

Traces the development of automatic train control in the United States, commencing with the development in 1916 of the automatic cab signal. Up to 1940, development proceeded along the now familiar lines of a central "dispatcher" originating signal and switch orders for a group of signalling points as d.c. codes, with return signals of the same type, and a train describer panel showing the track layout in miniature and the condition at any moment by means of small electric lamps. A single pair of wires conveyed the codes and provided a party-line telephone in addition, for a territory extending for about 75 miles. The impetus of war conditions in 1940 led to the use of different carrier frequencies over the pair for defining a number of different zones and the extension of control by a single dispatcher to zones extending up to 600 miles, as at Savannah on the Seaboard Air Line Railroad (see previous abstract). Present day systems of remote train-control include the use of microwaves and radar devices and storage of control orders on tape, etc. Miniaturization at the controlling station, together with the logical redesigning of the layout of switches and diagram has resulted in a 4 to 1 reduction in control desk size. The system has led to more efficient use of existing track, reduction of numbers of tracks in places, and is equally applicable to dense traffic areas, such as the rapid transit lines in New York City. W.J.Mitchell

621.398

546 A SYSTEM OF RADIO-CONTROL FOR THE PETROLEUM INDUSTRY. K.V.Belevich, V.P.Demeshin, V.A.Il'in and G.B.Suvorov.
Avtomat. i Telemekh., Vol. 8, No. 10, 934-6 (1957). In Russian.

A modulated carrier is used for the remote control of oil-drill holes. Eighteen carrier frequencies (of which one is used for telephony) are available in the system, in the range 46.1–48.5 Mc/s. Each carrier has twenty channels of modulation in the range 300–3000 c/s. Thus a total of 340 drill-holes may be controlled within the system. Schematics of the equipment are shown. T.Horrocks

621.398

547 CIRCUITS FOR SPACE PROBES. R.R.Bennett, G.J.Gleghorn, L.A.Hoffman, M.G.McLeod and Y.Shibuya.
Electronics, Vol. 32, No. 25, 55-7 (June 19, 1959).

The electronic payload of the Pioneer 4-stage rocket launched in Oct. 1958 is described briefly. The five f.m./p.m. channels telemetered ion density, two levels of micrometeorite impacts, magnetic field strength and temperature. The magnetometer was a 30 000 turn coil on a ferrite core spinning with the payload and produced a sine wave proportional in amplitude to the component of field perpendicular to the axis of the payload. A circuit of the transistor transmitter and block diagrams of the system and of the ground tracking station are given. W.G.Stripp

621.398 : 621-5

548 SEMICONDUCTORS IN TELECONTROL TECHNIQUES. A.de Quervain.
Elektrotech. Z. (E.T.Z.) A, Vol. 80, No. 15, 492-5 (Aug. 1, 1959). In German.

A general discussion of data and control transmission by digital and frequency-shift techniques, illustrated by a few typical circuits and one equipment. F.F.Roberts

621.398

549 ELECTRONIC TELEMETERING FOR POWER SUPPLY APPLICATIONS. S.John.
Elektronik, Vol. 8, No. 10, 299-305 (Oct., 1959). In German.

A review of apparatus extending from relatively simple equipment based on the torque-balance principle and producing in the pilot wires d.c. which is $\propto$ the quantity measured, to elaborate pulse equipment based on the time-multiplex principle and using transistors and semiconductor rectifiers. C.F.Pizzey

621.398

550 ANALYSIS OF MULTIPLEX ERROR IN F.M./F.M. AND P.A.M./F.M./F.M. TELEMETRY. J.Schenck and W.F.Kennedy.
I.R.E. Nat. Convention Record, Vol. 7, Pt 5, 184-96 (1959).

The errors considered are those that are produced in a channel of the multiplex resulting from arbitrary frequency and phase selective networks, and those resulting from the interference of adjacent channel sidebands with respect to an arbitrary channel centre frequency separation. To find these errors, a straightforward spectral analysis and synthesis is developed for practical models of standard f.m./f.m. and p.a.m./f.m./f.m. systems. Expressions are obtained for the outputs of a multiplex for given inputs, and for non-linear distortion and adjacent channel interference, in terms of the conventional parameters of such systems. This method of analysis is entirely quantitative, and an effort has been made to develop it from a definite theoretical basis.

621.398

551 AN INTERPLANETARY COMMUNICATION SYSTEM. G.E.Mueller and J.E.Taber.
I.R.E. WESCON Convention Record, Vol. 3, Pt 5, 68–80 (1959).

The problems associated with the transmission of experimental data from space probes to earth are discussed in general. A digital telemetry system, known as "Telebit", is described in detail and it is claimed that this system minimizes the airborne power and weight required and uses the effective channel capacity efficiently. The "Microlock" system used on the Pioneer series of lunar satellites and the Telebit system are compared in most aspects, excluding weight, and this comparison favours the Telebit system. The Microlock system has an effective information rate of about 0.5 bits/sec when transmitting 100 mW at lunar distances while the Telebit system, for the same power and distance, transmits 8 bits/sec. H.L.Nattrass

621.398

552 A TELEMETERING EQUIPMENT FOR ROCKETS OR SOUNDING BALLOONS. D.Eckhartt.
Onde elect., Vol. 39, 660-4 (July-Aug., 1959). In French.

Constructional details, aerial configurations and performance are described for a system operating at 210 Mc/s. The h.t. supply to the transmitter is derived from a 6 V battery by means of a transistor convertor. Receiving equipment is briefly described: maximum pick-up range, corresponding to 1μV received signal, is given as ~ 2000 km. The counting of cosmic radiation is given as a particular example of instrumentation. A.Reiss

COMPUTERS . APPLICATIONS

(Refer also to Digital circuits . Switching circuits)

681.142

553 CASCADED VARIABLE CYCLE CONTROL AS APPLIED TO THE 220 COMPUTER. E.L.Glaser.
Western Joint Computer Conference (See Abstr. 4755 of 1959). pp. 63-5.

Discusses a system of control employed in the Burroughs Corporation 220 computer and permitting microprogramming, which has similar requirements to those of interpretive programmes in that commands must be taken from memory and analysed before execution. The system employs two sets of pulses, the sequence and the digit pulses. Sequence pulses cause the progress of the machine through a set of orders defined by a stored command and decoded in a matrix; such orders are the clearing of registers, memory addressing and reading. When these preparatory orders have been carried out a chain of digit pulses initiated by the last sequence pulse carries out an arithmetic or shifting operation upon the numbers in the various registers. Completion of the digit chain permits the sequence pulses to continue and so carry further orders. Thus a cycle of operations has no fixed length in time although the numerical word length is fixed. The system has the advantage of allowing easy logical design but is not necessarily economical. G.H.Stearman

681.142

554 THE UNIVAC M-460 COMPUTER. J.E.Thornton, M.Macaulay and D.H.Toth.
Western Joint Computer Conference (see Abstr. 4755 of 1959) pp. 70-4.

A general description. Although this is a single-address machine, programme flexibility is such that the number of instruc-

tions required for a given operation is similar to that in a two-address machine. G.H.Stearman

681.142 : 621.396.96

555 A SPECIAL-PURPOSE SOLID-STATE COMPUTER USING SEQUENTIAL ACCESS MEMORY. W.A.Cornell.
Western Joint Computer Conference (see Abstr. 4755 of 1959). p. 74-9.

This computer accepts radar tracking information sequentially on up to 50 aircraft, calculates their flight rates and predicts flight paths on the assumption that the flight is unaccelerated and straight line between sampling intervals. The rate and predicted position are stored and corrected when new data is received from the radar. The resulting paths are displayed in 3-axis or 2-axis plan form on a cathode-ray tube. The programmes are wired into the machine. A special feature is the provision of a test programme which takes the form of flight path simulation under the control of an operator using a joystick and throttle control, the computer calculating and storing in a separate memory a sequence of flight positions. The machine may then be switched to predict a path from this information. G.H.Stearman

681.142

556 SYSTEM DESIGN OF THE GAMMA 60. P.Dreyfuss.
Western Joint Computer Conference (see Abstr. 4755 of 1959). p. 130-2.

The distinctive feature of Gamma 60 is its ability to carry out several programmes concurrently. This is achieved by organising the machine into a main store and an overall control which distributes programme instructions and data to a virtually unlimited number of operating elements, each of which has its own programme and control unit and can operate independently once given an instruction. G.H.Stearman

681.142

557 MACHINE LANGUAGE IN DIGITAL COMPUTER DESIGN. H.L.Engel.
Western Joint Computer Conference (see Abstr. 4755 of 1959). p. 182-6.

If the logical design of a computer is expressed, not in diagrammatic but in Boolean form it is said to be in machine language and may be operated upon by another digital computer. In particular, element inputs and outputs may be rapidly tabulated in various ways (using punched cards containing the logical information) allowing rapid appraisal of factors such as the avoidance of overload. A further possibility is the mechanical production of complete point-to-point wiring tables. The logic of a computer may by this means be simulated on another computer, showing up logical errors and thus hastening the progress to a final production model. A greater advantage still is envisaged in the use of a computer to improve the design economy of the simulated logic. G.H.Stearman

681.142

558 TRANSISTORIZED MODULAR POWER SUPPLIES FOR DIGITAL COMPUTERS. T.C.Gams.
Western Joint Computer Conference (see Abstr. 4755 of 1959). p. 203-7.

Discussion of problems peculiar to digital computer power supplies with emphasis on the means of obtaining a large variety of supply lines from only a few standard units. The use of a motor-alternator is recommended. G.H.Stearman

681.142

559 THE SHIFTRIX-MACHINE ORGANISATION FOR HIGH-SPEED DIGITAL COMPUTATION. G.Estrin.
Western Joint Computer Conference (see Abstr. 4755 of 1959). p. 207-11

The Shiftrix or shifting matrix is basically a means of multiplication. The multicand is applied to the columns of an nth order array and the multiplier is applied via a control, bit-by-bit to the rows. There are 2n - 1 diagonal lines feeding an accumulator. The control skips almost instantaneously any zero bits in the multiplier. Multiplier transformation to reduce the number of non-zero bits is discussed and the matrix principle extended to include division, code conversion and floating-point operations. The use of magnetic cores, diodes and transistors at the matrix intersections is briefly explained. The potential merit of the system lies in its ability to take the fullest advantage of time-reducing arithmetic organization methods. G.H.Stearman

681.142 : 621.317.79

560 AN ELECTROSTATIC INVERTER. T.Kohonen.
Ann. Acad. Sci. Fennicae A VI, No. 32, 11 pp. (1959).

The basic device consists of a capacitor connected at both ends through switch contacts to a supply voltage via a resistance. A short time later the switch contacts disconnect the source and the charged-up capacitor is then connected to an output capacitor which is shunted by a resistor. The switching operation repeats in the practical circuit at about 1 kc/s. An analysis of this basic charge-transfer circuit is given. To obtain a sign reversal the switching arrangements are in change-over form. A suitable combination of the basic and inverter circuits provides the facility of addition or subtraction. The performance of the unit deteriorates at about 200 c/s. The switches used in the prototype equipment were normal d.c. motor commutators. The unit is proposed as a cheaper alternative to an operational amplifier where the frequency and accuracy requirements permit. For the design considered the accuracy is stated as 0.5%. K.C.Garner

681.142

561 BLOCK DIAGRAMS IN LOGIC DESIGN. L.S.Bensky.
Western Joint Computer Conference (see Abstr. 4755 of 1959). p. 177-8.

Argument in support of the use of block diagrams in conjunction with symbolic algebra etc. in the design of computer logic. It is claimed that many major advances in design would not have come about without their aid. G.H.Stearman

681.142

562 LOGICAL DESIGN METHODS. R.K.Richards.
Western Joint Computer Conference (see Abstr. 4755 of 1959). p. 179-81.

Further critical comparison of logical equations and block diagrams (see previous abstract). G.H.Stearman

681.142

563 THE ADVANTAGES OF LOGICAL EQUATION TECHNIQUES IN DESIGNING DIGITAL COMPUTERS. V.L.Hesse.
Western Joint Computer Conference (see Abstr. 4755 of 1959). p. 186-8.

Arguments in favour of logical equations as opposed to block diagrams in logical design (see preceding abstract). Methods of simplification of Boolean logic expressions are applicable "tactically", that is once the main structure is determined, to attain maximum economy of elements; a "strategical" application is of greater importance, assisting, in the early design stage, to ensure best utilization of elements especially on a time-shared basis. Other advantages are mentioned. G.H.Stearman

681.142

564 EVAPORATED FILMS AND DIGITAL COMPUTERS. D.W.Moore.
I.R.E.WESCON Convention Record, Vol.3, Pt 4, 32-9 (1959).

A description is given of the evaporation process, including the advantages of using very low pressures and electron bombardment. Conducting films may be made from metals, resistance alloys or a combination of semiconducting and metallic materials chosen to give a high resistivity with a low temperature coefficient. The main difficulty with dielectric films is the occurrence of pin-holes. Magnetic films are suitable for bistable devices. Various forms of microcircuitry are briefly described, computers being a particularly suitable field of application. The interaction of magnetic domains in thin films can be used in a memory and in a domain stepping technique for digital logic. R.C.Kell

681.142

565 COMMUNICATION BETWEEN COMPUTERS. W.S.Knowles, I.L.Wieselman, and R.Stuart-Williams.
Western Joint Computer Conference (see Abstr. 4755 of 1959). p. 216-25.

The general problem of compatibility between digital computers (especially those using magnetic or punched tape inputs and outputs) is broken down into four levels: the physical-mechanical, physical-electrical, linguistic-formal and linguistic-variable. Three types of machine for the solution of some or all of these problems are defined, namely the adaptor, allowing for

differences in mechanical and electrical characteristics of the tape; the media translator, dealing in addition with the problems of differing tape format; the data convertor which also carries out full translation from one machine language to the other. The last should ideally be a special-purpose stored-programme computer. Examples are given of a media-translator and a sequence-controlled data convertor. G.H.Stearman

681.142

566 THE UNIVERSAL DATA TRANSCRIBER. A NEW APPROACH TO DATA-CONVERSION EQUIPMENT. M.S.Maxwell.
Western Joint Computer Conference (see Abstr. 4755 of 1959). p. 225-30.

Describes a stored-programme computer capable of very flexible data-conversion operations between computers. The use of a plug-board in addition to the stored programme permits microprogramming of certain parts of the logic concerned with the input and output of data, thus achieving economy of logic components and memory capacity. The order codes for the computer are discussed in an appendix. G.H.Stearman

681.142

567 A DEVICE TO FACILITATE COMBINED ANALOG-DIGITAL COMPUTATION.
B.L.Schwartz, G.Jenkinson, L.Winslow, B.Gordon and J.Solomon.
Western Joint Computer Conference (see Abstr. 4755 of 1959). p. 212-14.

A patching system permits versatile interconnection of relays, diodes, switches, stepping switches and a digital voltmeter in such a way that the analogue computer is periodically "held" while the output function is digitized and a card punch or printer operated. Computation is then allowed to proceed. The cards form the input to a digital computer. Applications have included study of ejector seat operation,and solar energy availability for an artificial satellite. G.H.Stearman

681.142

568 MULTIPLE-INPUT ANALOG-TO-DIGITAL CONVERTER WITH 12-BIT ACCURACY AND FAST, NON-SEQUENTIAL SWITCHING. H.S.Horn.
I.R.E. Nat. Convention Record, Vol. 7, Pt 4, 259-66 (1959).

The equipment described provides an interconnection between analogue and digital computational equipment. 64 analogue inputs are handled and conversions made to 12 bits in 936 μs, including selection time. Inputs are selected non-sequentially on demand from the digital computer to minimize input storage in the digital computer. The method avoids the need for fast electronic switches for selecting the analogue quantities by comparing all the analogue quantities simultaneously with the internally generated reference voltage and then using the result of one comparison at a time. This requires one comparator per analogue input channel but at the speed and accuracy needed these become cheaper and more practicable than switches. All but the comparator in use is disabled by a selecting signal controlled by the digital computer. Other details of the circuitry, such as the operational amplifier and a digital-to-analogue converter, are discussed in some detail and circuit and block diagrams are given. K.C.Garner

681.142

569 STUDY OF AN "ON-LINE" FIXED PROGRAMME COMPUTER. I. ADAPTATION TO DIGITAL COMPUTATION OF THE METHODS OF ANALOGUE COMPUTATION. A.Brèthes.
Automatisme, Vol. 4, No. 7-8, 287-92 (July-Aug., 1959). In French.

The author describes how digital computing elements may be used to replace, functionally, the corresponding elements of analogue computers. Such systems are then studied by difference equations instead of differential equations, and a corresponding theory of transfer functions and stability criteria is given. The problem of linear algebraic equations is selected for illustration. A.E.I. Research Laboratory

681.142

570 ELECTRONIC DIFFERENTIAL ANALYZERS IN PERSPECTIVE. J.McLeod.
Western Joint Computer Conference (see abstr. 4755 of 1959) p.82-6.

One of a set of 3 papers (see following abstracts) presenting arguments for analogue, digital and combined simulation systems; an illustration of a simple missile simulation is used to emphasise the salient features of analogue simulation. G.H.Stearman

681.142

571 THE CASE FOR COMBINED ANALOG–DIGITAL SIMULATION. W.W.Varner.
Western Joint Computer Conference (see Abstr. 4755 of 1959). p.86-7.

Describes experience of the use of analogue and digital computers linked by conversion equipment. Speed matching, maintenance and accuracy considerations are briefly discussed. (See also preceding abstr.). G.H.Stearman

681.142

572 DIGITAL COMPUTER SOLUTION OF DIFFERENTIAL EQUATIONS IN REAL TIME. H.J.Gray.
Western Joint Computer Conference (see Abstr. 4755 of 1959). p.87-91.

Brief details of a digital computer suitable for use with flight trainers are followed by a comparison of analogue and digital methods for this purpose and by a summary of appropriate numerical methods. The machine described was adequately fast for its application. (See also preceding Abstr.). G.H.Stearman

681.142

573 THE DESIGN AND SYSTEM ASPECTS OF THE HD FILE DRUM. H.W.Fuller, S.P.Woodsum and R.R.Evans.
Western Joint Computer Conference (see Abstr. 4755 of 1959). p. 197-203.

The special features of this drum store are the hydrodynamically maintained head spacing and the self-clocked read and write system. The drum surface is sprayed with oil and the heads, in contact with the drum when stationary, are lifted off by the oil pressure developed during motion. The self-clock system enables variable word-length to be used and special safeguards are provided to allow for the slow migration of writing positions with continuous rewriting. G.H.Stearman

681.142

574 METHODS OF FILE ORGANISATION FOR EFFICIENT USE OF I.B.M. RAMAC FILES. W.P.Heising.
Western Joint Computer Conference (see Abstr. 4755 of 1959). p. 194-6.

A description of the mechanical arrangement of this 50-magnetic-disk memory is followed by a general discussion of indexing methods leading to that used in this machine. In searching the file, addresses are generated by arithmetic operations upon an "item key"; if the information containing this item key is not found in the first address thus generated the search is directed by a "chaining" signal in that address to a second one and so on. If the required information is not found by the end of the chain it is not present in the file. The arithmetic operation referred to is so devised as to ensure that the chain lengths obey a Poisson distribution so that the average number of steps necessary to locate a particular file is $1 + f/2$ where f is the fraction of the total file in use. File additions and deletions are readily made. G.H.Stearman

681.142

575 CONTRASTS IN LARGE FILE MEMORIES FOR LARGE-SCALE COMPUTERS. J.A.Postley.
Western Joint Computer Conference (see Abstr. 4755 of 1959). p. 193-4.

Summary of characteristics of various types of high capacity storage devices. G.H.Stearman

681.142

576 THE MAGNETIC LEDGER-CARD COMPUTER. T.P.Holloran.
Western Joint Computer Conference (see Abstr. 4755 of 1959) p. 239-42.

Describes a relatively inexpensive computer suitable for small businesses and employing a slightly modified ledger-card. The most recent information in a card is stored on a magnetic strip down one side whilst earlier information is in printed form only. The computer allows rapid modification of the stored data by new data fed in from punched tape or cards or from another ledger-card. G.H.Stearman

681.142

577 A UNIVERSAL COMPUTER LANGUAGE TRANSLATOR. R.B.Bonney.
Western Joint Computer Conference (see Abstr. 4755 of 1959). p. 230-3.

The necessity for a special-purpose computer for computer language translation is established and a complete system for this

purpose described. Any kind of medium may be used as input or output of this machine and the control logic is greatly simplified by using sequential, rather than simultaneous input and output cycles. Practical experience with the translator has been encouraging.

G.H.Stearman

681.142

578 THE ROLE OF THE DIGITAL COMPUTER IN MECHANICAL TRANSLATION OF LANGUAGES.

D.L.Johnson.
Western Joint Computer Conference (see Abstr. 4755 of 1959).
p. 161-5.

Describes in general terms the work of one group in this field. A common procedure is the word for word translation using a stored dictionary, either of whole or dissected words, followed by successive applications of logical sequences to eliminate the inevitable redundancies and ambiguities arising from this process as well as to carry out word order rearrangement appropriate to the final language. A 30×10^6 bit photo-store with random access time of 0.05 sec is used for the dictionary, whose entries are tagged with a binary number relating to the grammatical usage and later logical processing, this being carried out by a standard computer. The latter, because of limited programme storage, carries out three successive processing cycles. At present mechanical translation is not economical compared with human translation but a really efficient reading machine would make it so. G.H.Stearman

681.142

579 A COMPUTER ORIENTED TOWARD SPATIAL PROBLEMS. S.H.Unger.

Western Joint Computer Conference (see Abstr. 4755 of 1959)
p. 234-8.

By considering the design of a computer suited to the needs of pattern recognition it is hoped to obtain a machine which may be useful in a wider class of problems. The computer contains a rectangular array of elements each of which contains a 1–bit accumulator, several 1–bit memory cells and some logic circuits. All elements are simultaneously controlled by a common central unit containing a stored programme. Two-dimensional patterns may then be represented by the states of these elements and various degrees of connection may be defined between them. The order structure is described and typical programmes given for the detection of lower left-hand corners and of vertical concavity and the doubling of lines. A practical embodiment of the computer would require many components and would be more expensive than is justifiable but improved construction techniques could improve this situation. The computer has been simulated on a standard machine. G.H.Stearman

681.142

580 A COMMAND STRUCTURE FOR COMPLEX INFORMATION PROCESSING.

J.C.Shaw, A.Newell, H.A.Simon and T.O.Ellis.
Western Joint Computer Conference (see Abstr. 4755 of 1959).
p. 119-28.

A series of languages, called information processing languages (I.P.L.) have been developed for the simplified programming of very complex problems, especially those which involve essentially human thought processes like chess playing, theorem proving, etc. The structure is quite novel, making no use of an arithmetic unit and employing a principle of memory addressing in which any word is associated with another which is next on a list of words. The words are merely symbols, not numbers, and may be manipulated in very complex and flexible ways. Reference to these symbols is not necessarily direct but may be through one or more other stages specifying that symbol. Empty memory locations are stored in a list waiting for use, erased locations being returned to this list and new ones taken from it. Many details of the language are described and it is emphasized that programming complexity is at present a limit on the potentialities of conventional computers for other than numerical work. I.P.L. has been used on existing computers at the cost of long computing time using interpretive routines but the structure ideally requires a special purpose machine to gain the maximum advantage, and memory capacity must be at least 10^9 words. G.H.Stearman

681.142

581 THE SELECTION OF AN INSTRUCTION LANGUAGE. W.Buchholz.

Western Joint Computer Conference (see Abstr. 4755 of 1959).
p. 128-30.

The selection of instruction sets for recently developed computers indicates a trend towards more complex instructions than were used in early stored programme computers. Instruction formats for several machines are cited. More complex instructions make possible shorter programmes with a gain in speed and storage space. G.H.Stearman

681.142

582 MINIMUM-SCAN PATTERN RECOGNITION. A.Gill.

I.R.E. Trans Inform. Theory, Vol. IT-5, No. 2, 52-8 (June, 1959).

Speedier and simpler pattern-recognition systems can be realized when provided with a minimum-scan reading device. For the idealized case, where the input set of patterns is finite, binary and errorless, a theorem is proved which enables the designer to predict the efficiency range of the contemplated reading device. A constructive method, which can be readily programmed for computer processing, is proposed for finding the shortest scanning path realizable for any given set. In the case of noise, scanning paths are sought which maintain a prescribed minimal "distance" between the patterns, and hence yield a prescribed level of error-detecting capability. The theorem previously proved is extended for this case, and a constructive method is proposed for finding the shortest path consistent with any specified minimal distance, for any given set of patterns.

o81.142

583 MACHINES FOR HANDLING NUMERICAL INFORMATION. A.Sestier.

Automatisme, Vol. 4, No. 7-8, 261-77 (July-Aug., 1959). In French.

A critical review of the machines exhibited at Auto-Math 59. The present trends indicate that the use of junction transistors is almost universal, that magnetic-core logical circuits are making progress in the slower machines and that subassemblies of from 50 to 200 components mounted on a printed circuit board form the detachable units from which machines are constructed. In the future there is promise of the use of superconductivity, of microwave frequencies and of photochemistry. However these new physical principles are perhaps not so important as the reductions in cost achievable by attention to the peripheral equipment and to automatic methods of manufacture of the basic units. The principal machines on view are briefly described: particular attention is given to the possibility of multiplexing programmes and to the various types of memories, including random access memories, now available. Medium sized and small computers are briefly mentioned as well as computer-like equipment such as the Flexowriter. Appendices describe the Parametron, Logimag and Symmag circuits, some semiconductor logical circuits and other particular devices.

G.A.Montgomerie

681.142

584 APPLICATIONS OF DIGITAL COMPUTERS TO PROBLEMS IN THE STUDY OF VEHICULAR TRAFFIC.

W.Hoffman and R.Pavley.
Western Joint Computer Conference (see Abstr. 4755 of 1959).
p. 159-61.

Data on journeys between any 2 of 265 traffic zones in Detroit and its suburbs were obtained by questionnaires and checked against sample counts taken on various routes. A matrix of order 265 is constructed in which an element a_{ij} represents the number of journeys between zone i and zone j in a period of 24 hours. Factors relating to the expansion of the zones are then applied by an iterative method to predict future traffic density. A procedure has been developed for constructing maps in which the results are displayed as areas of equal traffic density separated by isolines. The first prediction to be tested produced remarkably close agreement with actual conditions. Future work will include the prediction of traffic growth on trunk roads and over a much larger area, but the work is costly and lengthy and requires bigger computer capacity than is currently available.

G.H.Stearman

681.142

585 A CHESS PLAYING PROGRAM FOR THE IBM 704. A.Bernstein, M. de V. Roberts, T.Arbuckle and M.A.Belsky.

Western Joint Computer Conference (see Abstr. 4755 of 1959).
p. 157-9.

Describes a programme which enables a human being to play a game of chess with the computer. The machine is capable of playing a complete game of chess, including such moves as castling, promoting and capturing en passant, and plays a passable amateur game during the opening and middle game but is weak in finishing. Although the machine always makes the same move in any given situation, these are so numerous that the game is not predictable.

G.H.Stearman

681.142

586 DIGITAL COMPUTER PROGRAMS IN ELECTRIC UTILITIES. R.W.Long, R.T.Byerly and L.J.Rindt.
Elect. Engng, Vol. 78, No. 9, 912-16 (Sept., 1959).

A summary discussion of the types of programme available for solution of power system problems. The subjects considered are: load-flow studies, short-circuit studies, transient stability studies and problems of economic despatch of system generation and the closely allied problem of the development of power system loss formulae. In each case the special features of the programme in comparison with alternative methods, usually a.c. network analyser solutions, are mentioned, and the particular points which have to be kept in mind in preparing the problems for a digital computer are discussed. Most of the programmes mentioned apply to an IBM 704 computer. G.A.Montgomerie

681.142 : 621.311.16

587 SOME NOTES ON DIGITAL CALCULATIONS OF POWER SYSTEM SWING-CURVES AND THEIR ACCURACY.
C.Gram.
Ingeniøren C, Vol. 3, No. 3, 82-9 (Sept., 1959).

681.142 : 621.314.2

588 A COMPUTER PROGRAMME FOR POWER TRANSFORMER DESIGN. M.A.Spurway.
Engineering (London), Vol. 188, 73-4 (Aug. 21, 1959).

A computer programme is described which enables an automatic digital computer to make a preliminary design with the accuracy of a very experienced designer but in a very much shorter time. The machine used is a Ferranti Pegasus automatic digital computer. To produce a design, the specification for the required transformer is given to the machine as an input data tape. After the necessary calculation, the output data are first punched on paper tape and then converted into normal typewritten characters by a teleprinter. The input data, core cross-section, winding space factor, design method and programme assembly are considered.
Central Electricity Generating Board Digest

681.142 : 621.316.17

THE DESIGN OF HOUSING-ESTATE DISTRIBUTION SYSTEMS USING A DIGITAL COMPUTER. See Abstr. 107

681.142 : 621.316.11

THE LOGICAL DESIGN OF ELECTRICAL NETWORKS USING LINEAR PROGRAMMING METHODS. See Abstr. 103

681.142 : 621.374.32

589 CALCULATION OF TRANSIENT STABILITY PROBLEMS USING A HIGH-SPEED DIGITAL COMPUTER.
G.W.Stagg, A.F.Gabrielle, D.R.Moore and J.F.Hohenstein.
Trans Amer. Inst. Elect. Engrs III, Vol. 78, 566-74 (1959) = Pwr Apparatus Syst., No. 43 (Aug., 1959).

Describes the development of a computer programme for the solution of transient stability problems, involving both induction and synchronous machines, and performed entirely by digital computers without the need of a network analyser for such supplementary measurements as admittance constants, initial machine voltages, and slips. Experience in applying this transient stability programme to actual system problems is also discussed. The computer programme written for an I.B.M. 704, can represent a total of 50 induction and/or synchronous machines, 200 busses and 300 lines and/or transformers, and simulates automatically a desired sequence of fault conditions and switching operations. Any number of machines, including combinations of synchronous and induction motors or generators, can be represented on any single bus. The programme provides a tabulation of all system and machine voltages, machine currents, accelerating torques and slips at each time interval and, in addition, plots swing curves (slip versus time) of synchronous and induction machines for quick analysis during the calculations.

681.142

590 THE USE OF ELECTRONIC COMPUTERS IN THE FIELD OF CIVIL AND STRUCTURAL ENGINEERING.
A.M.Lount.
Engng J., Vol. 42, No. 7, 75-85 (July, 1959).

681.142 : 621.374.32

591 AN ORBIT PROGRAM FOR ENGINEERING USE.
B.H.Bloom and H.R.Smith.
I.R.E. Nat. Convention Record, Vol. 7, Pt 5, 240-50 (1959).

A philosophy of programming digital computers for engineering applications is presented. The concept of "minimum answer time" serves as a basis for this philosophy. Several programming techniques, which are implementations of this philosophy, are discussed. A programme for computing ballistic trajectories and orbits is described as an application.

681.142 : 621.395.5

592 THE APPLICATION OF A LARGE-SCALE ELECTRONIC COMPUTER TO THE ASSIGNMENT OF TELEPHONE FACILITIES. M.Drandell.
Western Joint Computer Conference (see Abstr. 4755 of 1959).
p. 165-8

A large telephone system having 66 central offices, each housing equipment to serve a particular area, may have as many as 4000 requests a day for new connections, disconnection, chage of address, alteration to the instrument, etc. The allocation of pairs in a cable is carried out by a computer which compares the service request information (punched on a card) with a magnetic tape file containing data on all existing connections. If pairs are not at first available an attempt will be made to rearrange existing connections so as to free pairs in the desired geographical location. G.H.Stearman

681.142

593 AN EXPERIMENT IN MECHANICAL SEARCHING OF RESEARCH LITERATURE WITH RAMAC. F.E.Firth.
Western Joint Computer Conference (see Abstr. 4755 of 1959).
P. 168-70

The information contained in a document is briefly described by short words and punched onto a card together with a serial number. Certain "home" addresses in the computer store contain the serial numbers of 12 documents described by a word associated with that address; further documents are listed in overflow addresses. The home addresses are maintained in a manual index against the descriptive words and searching requires the input of a card containing all the relevant home addresses after which a comparison between serial numbers detects those having descriptions in common with the request. Document input requires merely the insertion of its serial number in all appropriate home addresses or overflows. A descriptive word, if not already in the home address dictionary, initiates a print-out telling the operator to assign a new address. About 25000 documents each with 11 descriptive words may be stored and once a search card is prepared search time is less than a minute.
G.H.Stearman

681.142 : 621.374.32

594 AN APPLICATION OF DIGITAL COMPUTATION TO A PROBLEM OF ARMY TACTICS. J.Brick.
I.R.E. WESCON Convention Record, Vol. 3, Pt 5, 8-25 (1959).

The task posed was to determine whether high speed digital computation could be used by an army in the field in the planning of tactical operations. A fairly complex process, and one which, by manual techniques, involves a considerable expenditure of time is the planning of artillery fire in support of an offensive action. The task was studied and a procedure for using a digital computer was derived. The technique was then programmed and played on an available commercial machine. The feasibility of using computers in such applications was established. The problem areas were clearly in making a machine programme flexible enough to handle the unlimited number of contingencies which arise, and in man–machine communication.

681.142 : 621.313.333.1

595 SIMULATION OF THE THREE-PHASE SLIPRING ROTOR (MOTOR) ON THE ELECTRONIC ANALOGUE COMPUTER. L.Hannakam.
Elektronik, Vol. 8, No. 10, 315-19 (Oct., 1959). In German.

The theory of the motor is discussed and the matrix equations are developed. From these, the simulator interconnections are obtained and the circuit is given. Computed results of transients are illustrated and commented on. K.C.Garner

681.142 : 621.317.79

596 THE DESIGN OF INDUCTION MOTORS WITH THE HELP OF ANALOGUE COMPUTERS. W.Güttinger.
Bull. Assoc. Suisse Elect., Vol. 50, No. 20, 976-8 (Sept. 26, 1959).
In German.

The application of analogue computers to induction-motor design problems is demonstrated for the case of a motor-driven flywheel-type press operating on a duty cycle. A computing programme is outlined which permits the effects of changes in inertia or motor speed–torque characteristic on the r.m.s. motor load, load peaks and clutch torque to be quickly checked. H.Sterling

681.142

597 A NEW ANALOGUE COMPUTER FOR NETWORK OPTIMIZATION PROBLEMS. W.Schneider.
Elektrizitätswirtschaft, Vol. 58, No. 15, 524-32 (Aug. 5, 1959). In German.

Describes in detail the various criteria for the optimum economic utilization of arbitrary power networks containing both thermal and hydroelectric units. An actual analyser apparatus which yields a large amount of useful economic and other performance data for such a system whose loss matrix is given, is also described in detail. A.E.I. Research Laboratory

681.142

598 ELECTRONIC CO-ORDINATE TRANSFORMER. J.González-Ibeas and V.Aleixandre.
Electronic Radio Engr, Vol. 36, No. 10, 360-5 (Oct., 1959).

Describes a totally electronic analogue calculating unit designed to obtain the modulus of a vector and the value of the sine and cosine as a function of the rectangular components of that vector. By adding two sinusoids, the amplitudes of which are proportional to the rectangular coordinates and which are 90° out of phase, another sinusoid is obtained, the amplitude of which is proportional to the modulus and the phase-shift proportional to the argument of the vector. Starting from this wave another of the same phase and constant amplitude is generated, and from this the values of sin ϕ and cos ϕ are deduced.

681.142

599 AN ANALOG COMPUTER FOR ON-LINE REACTOR CONTROL. E.D.Tolin and D.A.Fluegel.
I.S.A. J., Vol. 6, No. 10, 32-8 (Oct., 1959).

A special purpose real-time computer is described which continuously scans 14 process variables. From these input data a heat balance for the exothermic chemical reactor is computed. It has previously been found that the heat balance is a significant characteristic of the reactor operation. The computer output automatically controls one of the variables to yield a constant production rate. The instrumentation of temperature and flow at the different locations on the plant is stated, and the actual computer is described in reasonable detail with illustrations. The computing techniques are not novel, but the application and programming system are. K.C.Garner

681.142

600 PRACTICAL APPLICATIONS OF TIME DOMAIN THEORY. J.T.Bangert.
I.R.E. WESCON Convention Record, Vol. 3, Pt 2, 29-38 (1959).

It is shown that numerical sampling methods and the judicious use of analogue computation provide a useful practical alternative to integral transforms in the conversion between time and frequency domains. V.G.Welsby

681.142 : 621.316.11

601 A.C. NETWORK ANALYSERS. G.Funk.
A.E.G. Progress, 1958, No. 4, 339-44.

English translation of a paper already abstracted in Abstr. 4076 (1958).

681.142

602 THE RCA 501 ELECTRONIC DATA PROCESSING SYSTEM. G.E.Poorte and A.S.Kranzley.
Western Joint Computer Conference (see Abstr. 4755 of 1959). pp. 66-70.

General description of a commercial system incorporating a large magnetic tape memory in addition to a high-speed memory and organised to permit simultaneous computation, input and output. G.H.Stearman

681.142 : 621.398

603 A HIGH-SPEED, AIRBORNE DIGITAL DATA ACQUISITION SYSTEM. S.Cogan and W.K.Hodder.
I.R.E. Nat. Convention Record, Vol. 7, Pt 5, 159-65 (1959).

The system accepts low-level (± 10 mV) analogue voltages from transducers, commutates and amplifies these inputs, and converts them sequentially to digital form. Output is of digital words recorded on magnetic tape and transmitted serially through a p.c.m./f.m. transmitter (for reception on the ground and transfer to an I.B.M. 704 computer) with a bar chart display for in-flight monitoring. Most of the system uses silicon transistors and works from −55°C to +82°C. Each of 100 data channels is sampled 500 times/sec and converted to a 10-bit-plus-sign word (giving a resolution of 1 in 2048); capacity can be expanded by subcommutation of any channels in ratios of 10/1 or 100/1. Block diagrams are given of the various units, such as amplifiers, transistor switches, and subcommutators, the automatic standardization unit, the analogue-to-digital convertor, and the programme control unit which enables the system to be adapted to different sets of inputs by changing programming circuit cards. Accuracy is between 0.1% and 0.5% over a 12-hour period. G.A.Montgomerie

681.142 : 621.395.625.3

A NEW AIRBORNE MAGNETIC-TAPE DATA RECORDER.
See Abstr. 439

681.142

604 AUTOMATIC DATA TRANSMISSION TO MULTIPLE RECEIVERS WITHIN THE MISSILE MONITOR SYSTEM. L.H.Kurkjian.
I.R.E. WESCON Convention Record, Vol. 3, Pt 5, 32-40 (1959).

The Missile Monitor System is a mobile special-purpose data-processing and computing system that has been developed to detect targets and coordinate the fire of ground-based antiaircraft missiles. Transmission of track and engagement data throughout the M.M.S. is accomplished automatically by the use of digital data link equipment which is controlled by data processors. The central data processor, located in a weapons monitoring centre, controls the transmission and reception of data to and from the weapons batteries integrated in the missile monitor net. Some of the system communication problems and their solutions by using a data processor to control the digital communications network of the M.M. are discussed.

681.142

605 SAGE DATA SYSTEM CONSIDERATIONS. R.G.Enticknap and E.F.Schuster.
Trans Amer. Inst. Elect. Engrs I, Vol. 77, 824-32 (1959) = Commun. and Electronics, No. 40 (Jan., 1959).

A general discussion of the system for the transmission of binary digital data over telephone circuits in connection with the SAGE (semiautomatic ground environment) system of air defence. In the original scheme the data processing device (slowed-down video) gave 1600 bits/sec. but later a new machine (fine grain data) was developed and needs two 1300-bit circuits. Because leased telephone circuits had, for economic reasons, to be adopted and because the type of noise encountered gave rise to difficulties, a specification for the quality of the circuit was agreed with the telephone administration, and the type of signal used was also carefully chosen. Both these specifications are given in detail in appendices (see also two succeeding abstracts). The system composition (input sources, output requirements, etc.) is discussed, and the operational requirements (restoration, route selection, etc.) given. G.A.Montgomerie

681.142

606 COMMUNICATION CHANNELS FOR SAGE DATA SYSTEMS. R.T.James.
Trans Amer. Inst. Elect. Engrs I, Vol. 77, 838-43 (1959) = Commun. and Electronics, No. 40 (Jan., 1959).

Details of the communication channel specifications for SAGE (see preceeding abstract). The short-time error rate must not exceed one per 100 000 bits and in most channels there must not be a gross system malfunction of more than 30 sec. To meet the second requirement, duplex circuits (block diagrams are given) are used. Information is at 1300 or 1600 bits/sec and contains several types of information combined as modulation of a 2 kc/s carrier (see succeeding abstract). The limits of allowable distortion and noise if the required error rate is not to be exceeded are discussed. G.A.Montgomerie

681.142

607 SAGE DATA TERMINALS. R.O.Soffel and E.G.Spack.
Trans Amer. Inst. Elect. Engrs I, Vol. 77, 872-9 (1959) = Commun. and Electronics, No. 40 (Jan., 1959).

The terminal apparatus (Western Electric A1) used in connection with the SAGE system is described. The data source furnishes to the transmitter timing information (1300 or 1600 c/s), message information in the form of marks and spaces, the marks being dipulses or single complete cycles of the basic frequency, and start information, also dipulses, which group the data into words. The transmitter converts these three outputs into a single, 3-valued signal which is then applied as modulation to a 2 kc/s carrier. The receiver has the inverse function of detecting the presence or absence of data or start pulses in the line signal, generating a timing wave synchronous with the original timing wave, producing an output containing data and start dipulses corresponding to the original signals from the data source. The trouble detector which automatically switches to a second channel as required is also briefly described. G.A.Montgomerie

MECHANICAL AND CIVIL ENGINEERING TECHNOLOGY

621.67 : 621.313.333.2

608 SUBMERSIBLE PUMPING PLANT. H.H.Anderson and W.G.Crawford.

Proc. Instn Elect. Engrs, Paper 3147U, publ. Nov., 1959, 12 pp. To be republished in Vol. 107A (1960).

Submersible pumping units have been developed to a sufficiently high degree of reliability and efficiency to capture a large part of the field previously held by the conventional borehole pump with surface motor. The paper commences with a description of the submersible pump and the submersible motor as separate units, together with sectional drawings, constructional details and performance characteristics. An investigation is made of the efficiency, testing and behaviour of the pump and motor under abnormal and transient conditions of starting, zero-head operation and reverse rotation, details being given of the energy dissipation and the turbine phases of the pump and of the runaway speeds attained in the reverse rotation. The question of optimum diameter of the pump set and borehole for water-supply installations is examined from the economic aspect, and the implications of corrosive waters are studied. Problems arising from the linkage of the pump to the motor include the radial and axial loadings from pump to motor thrust bearings, the effect of these loadings in producing upthrust and downthrust and the motor starting-torque investigations.

MATERIALS . TESTING

620.11

609 THE MANAGEMENT OF QUALITY CONTROL. A.M.Gervaise.

Cables et Transm., Vol. 13, No. 1, 3-15 (Jan., 1959). In French.

The management of quality control involves the preparation of specifications, the planning necessary to achieve an adequate level of consistency and the checking on the quality obtained. These operations are defined and elaborated upon. The application of the necessary data to a theoretical supervision of quality involves the use of methods borrowed from statistical mathematics; these are numerous and sometimes complicated. Among them, the graphical method for control of consistency is widely applied to mass-production; it is quick and shows up assignable causes for quality variations. A number of examples of the application of this method is given. 7 references. E.F.Hansford

620.172.222

610 SHUNT BRIDGE BALANCING IN STRAIN GAUGE INDICATORS. C.H.Haakana.

Electronics, Vol. 32, No. 30, 50-1 (July 24, 1959).

When conventional self-balancing potentiometer-type indicating instruments are used, highly stable power supplies and accurate reference voltages are normally employed to make the readings independent of variations in the power supply. When shunt balancing is employed, the bridge, comprising the transducer circuits and the associated balancing potentiometer with slider moved by the servo motor, is always balanced resistively for each change in the variable. Consequently, the only requirement of the power supply is that it is sufficient to provide a sharp null in the servo amplifier and that it does not exceed the voltage rating of the transducer. The construction of the balancing potentiometer is then not critical and its temperature coefficient unimportant. Circuits can be introduced between the transducer and the potentiometer slider for compensating for temperature and other effects in the transducer itself. A.C.Whiffin

620.179.152

611 RADIOGRAPHIC INSPECTION TECHNIQUES FOR WELD EXAMINATION. R.Halmshaw.

Brit. Weld. J., Vol. 6, No. 10, 456-61 (Oct., 1959).

The factors to be considered in deciding on the details of a radiographic technique suitable for weld examination are discussed. It is shown that with most equipment a compromise has to be made between attainment of the best possible definition and an economic exposure time. The smallest size of defects of different shapes which may be detected by radiography is discussed, and a method of calculating the dimensions of just-detectable cracks is proposed, which has been shown to agree with experimental results. The radiographic examination of steel welds thicker than 3 in. is discussed with reference to the performance of available equipment.

620.179.16

612 ULTRASONIC TESTING OF WELDS. D.O.Sproule.

Brit. Weld. J., Vol. 6, No. 10, 470-9 (Oct., 1959).

Reviews the main principles and procedures that have found practical application in the testing of welds. The discussion of physical principles is centred on the correct choice of frequency and pulse length as affected by surface condition, grain size, and the required resolving power. The potentialities of focusing probes and point probes are discussed, together with single and double probe working. The consideration of practical procedures includes ultrasonic testing of parent metal for laminations and variations in thickness, couplants for different conditions, standards established by the use of calibrated attenuators or test blocks, forms for the recording of results, and special problems associated with the testing of welds in very thin and very thick plate.

620.179.16 : 621.315.62

613 NON-DESTRUCTIVE TESTING OF HIGH-VOLTAGE INSULATORS USING ULTRASONICS. H.Weissmantel.

Scientia Electrica, Vol. 5, No. 3, 113-20 (Sept., 1959). In German.

A brief survey is given of different porosity test methods for porcelain insulators, and ultrasonic testing is then dealt with. The method is described by use of typical oscillograms. Tests with oblique incidence of the ultrasonic beam into the cones of rod-insulators as well as the examination of installed or hollow or fitted insulators are discussed. The last part deals with ultrasonic tests followed by fuchsine tests. These tests entirely confirmed the value of carefully used ultrasonic tests for the non-destructive testing of ceramic insulators.

620.19 : 539.21

614 THE APPLICATION OF IRRADIATION IN INDUSTRY. M.C.Crowley-Milling.

Proc. Instn Elect. Engrs, Paper 3145U, publ. Oct., 1959, 13 pp. To be republished in Vol. 107A (1960).

A survey of the types of radiation shows that only γ-rays and high-speed electrons are worth consideration for industrial radiation. Possible applications and the methods of producing such radiation are discussed briefly. The problems of the introduction of irradiation into industry are examined, and the methods applying electron irradiation are explained in detail. A typical installation is described, and the economic aspects are considered.

WELDING . SOLDERING

621.7.01

615 ULTRASONIC WELDING EQUIPMENT.
J.N.Antonevich.
I.R.E. Nat. Convention Record, Vol. 7, Pt 6, 204-12 (1959).

Two materials can be welded if they are clamped together and made to slide in contact. Under certain conditions the surfaces will then interact metallurgically to eliminate the interface. The basic mechanisms of this phenomena are discussed and experimental results presented, showing variation of weld strength with clamping force, displacement of sliding surfaces and temperature reached at interface. For maximum weld strength these parameters should be optimized. When welding a $\frac{5}{16}$ inch radius Monel sphere to a copper plate $\frac{1}{4}$ inch thick a maximum weld strength of 300 lb was achieved with a 100 lb clamping force, an 0.9 mil displacement (at 20 kc/s) and a weld time of 3 sec. Present indications are that butt, seam and spot welders can be designed for welding thin sheets or small components made of ductile materials. 20 references.

A.P.C.Thiele

621.791.75

616 A NEW ELECTRO-SLAG WELDING PROCESS.
D.J.W.Boag and W.K.B.Marshall.
Brit. Weld. J., Vol. 6, No. 11, 507-13 (Nov., 1959).

A description is given of the Rockweld-Vus "Vertomatic" electro-slag welding machine. This differs from the Russian machines in having articulated water-cooled shoes, automatic control of the shoe motion and flux feed, and in using a special composite wire. Factors affecting weld-metal properties are discussed in detail. The process appears to give welds of acceptable properties in the as-welded or stress-relieved conditions.

621.791.7 : 621.382.2

617 COLD PRESSURE-WELDING AND ITS INFLUENCE ON DEVICE DESIGN AND MANUFACTURE.
D.Boswell and R.Humphrey.
Proc. Instn Elect. Engrs, Paper 2995E [International Convention on Transistors and Associated Semiconductor Devices], publ. 1960 (Part B, Suppl. No. 15, 454-8).

A brief discussion of the effects of cold welding on container design is followed by considerations of tool design and an assessment of the process on a production scale. Surface preparation and component dimensional control are prime considerations.

621.9

618 NUMERICAL CONTROL OF MACHINE TOOLS.
D.N.Chorafas.
Electricien, Vol. 87, 155-60 (Aug., 1959). In French.

A brief but comprehensive review of current trends.

A.O.Stanesby

LIST OF JOURNALS

The following list supplements the List of Journals to be published with the Index to Volume 62 (1959). Reprints of the List of Journals will be obtainable from The Institution of Electrical Engineers, Savoy Place, London, W.C.2, price 2s.0d. post free.

The addresses given are believed to be correct at the date of publication, but no responsibility can be accepted for errors.

Electronic Radio Engr	Electronic and Radio Engineer Title changed to Electronic Technology [Electronic Technol.] with the issue dated January, 1960.
Electronic Technol.	Electronic Technology (Formerly: Electronic and Radio Engineer). Iliffe and Sons, Dorset House, Stamford Street, London, E.C.1.
Elektronische Rechenanlagen	Elektronische Rechenanlagen [Article reprinted in: Entwicklungsberichte der Siemens und Halske Aktiengesellschaft].
ForschBer. Landes Nordrhein-Westfalen	Forschungsberichte des Landes Nordrhein-Westfalen (Formerly: Forschungsberichte des Wirtschafts- und Verkehrsministeriums Nordrhein-Westfalen). Westdeutscher Verlag, Ophovener Strasse 1-3, Cologne.
Forschungsber. Wirtsch.-Verkehrsmin. Nordrhein-Westfalen	Forschungsberichte des Wirtschafts- und Verkehrsministeriums Nordrhein-Westfalen Title changed to: Forschungsberichte des Landes Nordrhein-Westfalen [ForschBer. Nordrhein-Westfalen].
J. nuclear Energy	Journal of Nuclear Energy From the beginning of 1959 this journal will be published in three parts: Reactor Science (Part A); Reactor Technology (Part B); Plasma Physics—Accelerators—Thermonuclear Research).
Power Engr	Power Engineer The Society of Power Engineers, Cleremont, Simla 4. Publication address: Bikener House, Shahjahan Road, New Delhi 2.
Publ. sci. Univ. d'Algér	Publications Scientifiques de l'Université d'Algér. Serie A (Algér-Mathématiques); Série B (Algér-Sciences Physiques). Faculté des Sciences, L'Université d'Algér, 2 Rue Michelet, Algiers.
Reactor Sci.	Reactor Science (Journal of Nuclear Energy, Part A). Pergamon Press, 4 and 5, Fitzroy Square, London, W.1; 122 East 55th Street, New York 22, N.Y.
Res. Bull. Saugar Univ. Phys. Soc.	Research Bulletin of the Saugar University Physical Society Saugar, M.P. (India).
Tech. Mitt. B.R.F.	Technische Mitteilungen aus dem Betriebslaboratorium fur Rundfunk und Fernsehen (BRF). Agastrasse, Berlin-Adlershof.
Wood	Wood The Tothill Press, 33 Tothill Street, Westminster, London, S.E.1.
Telefunken Ztg	Telefunken Zeitung Address changed to: Telefunken GmbH, Ernst-Reuter-Platz, Berlin-Charlottenburg 1.

NEW JOURNAL

J. mech. Engng Sci.	Journal of Mechanical Engineering Science The Institution of Mechanical Engineers, 1 Birdcage Walk, Westminster, London, S.W.1. Quarterly. Vol. 1, No. 1 dated June, 1959.

ABSTRACTING JOURNALS

Associated Electrical Industries (Manchester)	Associated Electrical Industries (Manchester) Limited, Research Department Technical News Bulletin (Formerly: Metropolitan-Vickers Technical News Bulletin [Signature: Metropolitan Vickers]). Trafford Park, Manchester 17.
Metropolitan-Vickers	Metropolitan-Vickers Technical News Bulletin Title changed to: Associated Electrical Industries (Manchester) Limited, Research Department Technical News Bulletin [Signature: Associated Electrical Industries (Manchester)] with issue dated January 1, 1960.
Science Abstracts of China	Science Abstracts of China (Mathematical and Physical Sciences; Chemistry and Chemical Technology; Biological Sciences; Earth Sciences; and Technical Sciences). The Institute of Scientific and Technical Information of China, 117 Chao Yang Men Street, Peking.

ERRATA

Abstr. 4570 (1959) line 11 : for "transidyne" read "Transidyne" (this term is a Registered Trade Mark).
Abstr. 5054 (1959) line 10 : for "normal generating" read "operating".
Abstr. 5647 (1959) line 3 : for "(May-June, 1959)" read "(May-June, 1958)".
Abstr. 5652 (1959) line 3 : for "Automat." read "Avtomat".
Abstr. 5797 (1959) line 5 : for "13 times" read "$\sqrt{3}$ times".
Abstr. 5979 (1959) line 2 : for "M.E. Pio" read "E. Pio".
Abstr. 6008 (1959) line 2 : for "[Le BRUIT DE FORD]" read "[Le bruit de fond]".
Abstr. 6158 (1959) line 2 : for "Kot'tsov" read "Kol'tsov".
Abstr. 6736 (1959) line 2 : for "N.N. Fullilove" read "M.N. Fullilove".
Abstr. 6787 (1959) line 2 : for "K.M. Siegal" read "K.M. Siegel".
Abstr. 6832 (1959) line 3 : for "See also preceding abstract" read "See Abstr. 7668 of 1959".
Abstr. 6881 (1959) line 2 : for "J. Zaborsky" read "J. Zaborszky".
Abstr. 7015 (1959) line 7 : for "30 kΩ6" read "30 kΩ".
Abstr. 7216 (1959) line 6 : for "3.5 volts" read "3.8 volts".
line 8 : for "Zr:UC" read "ZrC:UC".
Author Index (1959) p. 788, column 1 : Kreuder, N.L.; add entry "Electronic design: reliability versus manufacturing cost, 7468".
p. 825, column 2 : delete "Swarup, G. and Yang, K.S. Interferometer phasing at microwave frequencies, 7468".
p. 837, column 1 : delete "Yang, K.S. See Swarup, G. 7468".
Subject Index (1959) p. 842, column 1 : under Aerials, directive, delete line 31.
p. 867, column 2 : under Electronic equipment, insert "economic considerations, 7468" between lines 72 and 73.

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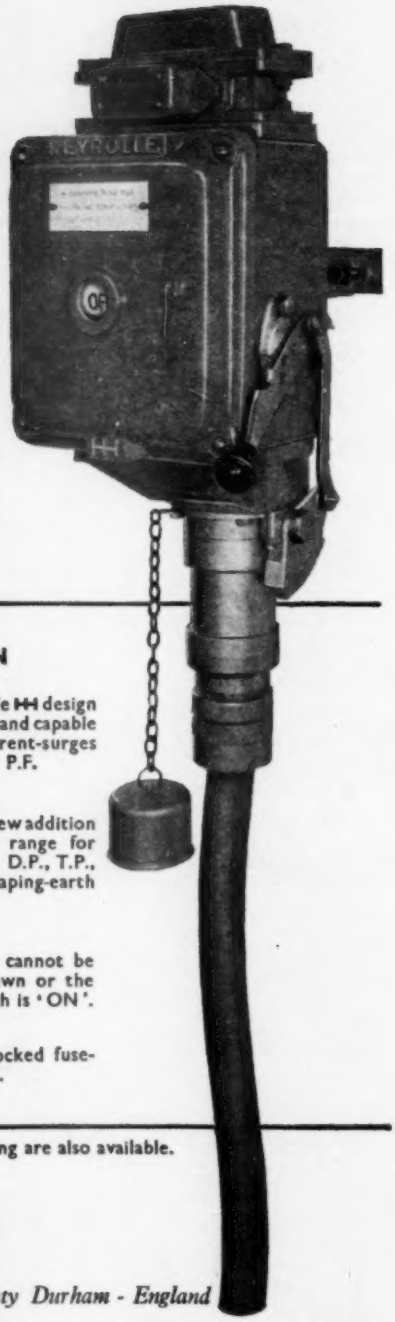

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